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ELECTRIC TRACTION IN NEW YORK CITY.

In our issue of last week, we commented upon the announcement by the Metropolitan Street Railway Company, of New York City, of its intention to adopt electric traction on all of its lines, and also referred to the probable action on the part of the Eighth Avenue line to the same effect. During the past week the Third Avenue railway has announced its decision to adopt an underground conduit system for application over its entire system, and it is reported that the Sixth Avenue line will follow suit. The Third Avenue line has already, it may be remarked, a half mile of electric conduit road almost ready for operation on Amsterdam Avenue, the public, it seems, having up to the present been led to believe that this section was being prepared for cable operation. It is also reported that the Madison Avenue line intends to adopt storage battery traction, the system to be similar to that in such successful use in Paris. In this case, however, final adoption will depend upon the results of trials soon to be commenced with a single car. What has primarily led to the sudden favor with which electric traction is now generally viewed by New York City street railway companies is doubtless the recent statement of President Crimmins in regard to the immense saving in operating expenses entailed, which, he said, amounted to four cents per car-mile over the cable and eight cents over horses. One of the street railway officials in an interview referred to other weighty advantages in favor of electric cars, such as their ability to run backward, the lack of which quality in cable traction has been found a great drawback, as also has the complication of pulleys in going around curves, and the impracticability of transfering cable cars around a section of road blocked by a fire. It now seems probable that every street car line in the city will be operated by electricity within five years. The Third Avenue line expects to have its entire system transformed by 1897, and work has already been begun on the Twenty-third Street line of the Metropolitan Company, which also intends soon to start work on the Ninth Avenue and Belt lines. As the adoption of electricity by the elevated roads for motive power is in the near future and the underground rapid transit roads are to be designed for electric traction, the end of the century will witness the complete suppression within the city limits of other sources of rail tractive power, except, perhaps, on the termini of steam railways.

SPRINGFIELD MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The meeting at Springfield last week of the American Association for the Advancement of Science, while not so well attended as some of the previous gatherings of this body, was nevertheless a success if judged by the number and character of the papers read. Electricity was well represented on the programme, and the number of papers on electrochemical subjects is significant of the rapidly growing importance of this branch, which is believed by some well qualified to form an opinion on the subject, to contain more promise for the future than any other department of electrical science. The vice-presidential address of Dr. McMurtrie dwelt upon the manner in which the electric current is being applied in chemical work, the statement being made that from no other source, either in the laboratory or in the works, has so rich a yield in new materials resulted. Acetylene naturally commanded attention in the address, and while Dr. McMurtrie is non-committal as to its value as a gas enricher, he regards the material as offering a starting point for many valuable investigations. In higher electrical science there were several papers read, of which that by Prof. Childs records the discovery

of certain phenomena of electric waves analogous to those of light with a diffraction grating, thus adding another proof of the Maxwellian theory. Dr. Pupin in one paper communicated a mathematical and experimental discussion of the flow of alternating currents in conductors, which resulted in the addition of some terms to the previously accepted equation; and in another discussed the general relation between electric and magnetic forces and their displacements, deducing finally an additional law which, when added to those already accepted, explains equally well the phenomena of light and those of electricity without further hypothesis. The vice presidential address on "The Relation of Engineering to Economics" appears to be in great part a proof of what is never denied—the preponderating effect of applied science in the advancement of the world in social comfort and material wealth. The prediction that by a process of evolution to be commenced in the future capital and labor will coalesce through the laborers becoming capitalists, is one for which it would be extremely difficult to find any real basis in our present social condition. As speculative thought is characteristic of the meetings of associations for the advancement of science, we presume that its presence here is, under the circumstances, to be expected.

ELECTROLYTIC WHITE LEAD.

If the glowing terms in which a process for the electrolytic manufacture of white lead described in a paper read before the Springfield meeting of the American Association for the Advancement of Science are not merely the expressions of an enthusiast, electricity has indeed made another notable achievement. The paper informs us that by the electrolytic process described white lead of the very finest variety is produced in a few hours, whereas, as is well known, by the usual process months are necessary to attain the same end. As to cost, the author states that this "need not detain us long. Suffice it to say that it is but a fraction of the cost by the Dutch method"—the latter being the present method of production. While the paper referred to indicates a buoyant confidence on the part of the writer somewhat comparable to that which animated Colonel Sellers, yet we trust that its statements can be substantiated, and that the field thus opened may be explored in many other directions with like results.

ELECTRICAL CONSTRUCTION WORK.

The article by Mr. Keppele Hall in another column on "A Plea for Better Construction Work" will well repay reading by electricians doing construction work, and prove of even more value to those having such work done. The conditions referred to as to the character of workmen employed and the custom of selecting the lowest bidder when competing proposals are asked, are, we fear, generally prevalent outside of our larger cities. While Mr. Hall considers the most salient points relating to the subject treated there are yet several that may be referred to as having a greater or less unfavorable influence on the character of electrical construction work. In other trades, such as plumbing, for instance, the employer or foreman directing work knows at least when work is being properly done, having, with rare exceptions, attained a superior position only after some years' practice of the trade, and usually through the possession of technical qualities placing him above the average workman. As a consequence, if bad work in these branches is done, it can almost always be ascribed to intention, sometimes dishonest in its origin, and at other times resulting from low prices due to competition. A different state of affairs, however, obtains with respect to electrical construction work, except in cities, where electrical trade unions have tended to keep down the amateur electrician and "jerry" wiremen. Elsewhere, in too many cases, the electrical workman bears a similar relation to the trade he follows that the farmer accustomed to patching his property or building fences and sheds does to carpentry. Owing to the delusion about electricity being in its infancy, many young men are attracted to that industry who would not think of submitting to the drudgery necessary to become qualified in an ordinary trade, or who consider that the occupation of electrician is not to be associated with the usual trades from a social standpoint. If possessed of means, or executive qualities, in a very short time the apprentice becomes an employer or foreman, a position to which in another trade he could not hope to aspire for years. That is to say, the knowledge of minutæ and details which characterizes the true workman, and more particularly, which should be possessed by the one responsible for the execution of work, is lacking. The amateurish workmanship resulting from these causes is probably more frequent outside of cities than has ever been the case in any other trade, and promises to so continue as long as the electrical business is looked upon as one not involving the principles applying in other lines, as at present seems to be done. A corrective to this condition lies with the insurance interests, and we believe that its application would be everywhere welcomed by the competent electrical contractor, and would result in establishing construction work upon the same basis as other trades, as well as prove a great benefit to the really capable workman by protecting him from the competition of tyros. By a proper system of insurance inspection such an end might be measurably achieved, and doubtless with profit to the insurance companies. Such a system would involve the division of territory into districts, each in charge of a competent electrical expert, whose duties should be to visit the local inspectors at intervals and instruct them in the interpretation and application of electrical insurance rules, and, in case of dispute, have the matter at issue referred to him for final action. With a general body like the present National Association of Underwriters' Experts to supervise the formulation of rules, and at its stated meetings consider important questions reported for action by the district experts, a uniformity of practice would also result that would remove the present reproach against underwriters' electrical inspection and at the same time be of great benefit in this respect to the entire electrical industry. While the remedy is not an ideal one, and to some will appear like delivering oneself to the enemy, it is the only one that seems at all within reach to apply to the evils of which complaint is made.

Cabling the Yacht Race.

The transatlantic cable lines on Saturday broke the record for quick cabling. The Commercial Cable Company had ordered its cable steamer, Mackey, to New York, and a cable specially made for the purpose was laid to the shore from the ship, which was anchored at an advantageous point to see the race. After all preparations were thus made, the racing course was shifted, but in a very short time another length of cable was spliced and a new position taken by the ship. The line from the ship was in direct connection with the transatlantic cable, the messages thus being transmitted directly to Europe.

One Way of Avoiding Danger.

In the recent Institute paper by Dr. Bleile, he stated that by administering nitrate of amyl to the animals on which he experimented, he enabled some of them to withstand the current for a longer time. In commenting on this statement our London contemporary, *Lightning*, says that "it follows that all persons liable to accidents of this kind should, just before they expect to receive the shock, inhale nitrate of amyl until they lose consciousness." Doubtless many line men would be quite pleased with the idea of being made unconscious during the working hours.

The Schoellkopf Niagara Plant.

The Schoellkopf Hydraulic Power & Manufacturing Company on Sept. 3 let a contract to the John Leffel Company, of Springfield, O., for three turbines of 1,650 hp each, to be used in the new electric power station of the company on the bank of the Niagara River, below the Suspension Bridge.

The Berliner Case.

The United States Circuit Court of Appeals at Boston, on Sept. 3, allowed counsel for the government in the Berliner case to take an appeal of that case to the United States Supreme Court. The counsel for the American Bell Company made a motion for a mandate dismissing the bill in the original suit, which was allowed, but upon a motion by Mr. Causten Brown, counsel for the government, the appeal referred to was allowed, the effect of which supersedes the mandate and leaves the case to be heard anew by the Supreme Court at Washington.

The Buffalo-Niagara Franchise.

The Niagara Falls Power Company has refused to accept the terms offered by the committee of the Buffalo Council entrusted with the task of drafting a franchise. Secretary Rankine says that the company does not want the franchise in its present form. Commenting on this action, the Buffalo *Enquirer* says that the franchise offered the Niagara Falls Power Company is, in most respects, a fair one. "The committee, after long delays, drafted a contract which gave the company important privileges. The city of Buffalo is not going to make many more concessions. The matter is in such a form now that the Niagara Falls Power Company can do business if it wants to."

The Montreal Street Railway Convention.

Arrangements have been made for a special train to the Montreal Convention of the American Street Railway Association, via the New York Central & Hudson River Railway, for the accommodation of delegates and others attending the convention. The special train will leave the Grand Central station at New York, on Monday, Oct. 14, at 6 p. m., arriving at Montreal the next morning in time for breakfast. Passengers from all points west can connect with the special at Utica, N. Y. Arrangements are also being made for a daylight return trip through the Adirondacks, including a stop at Lake Saranac. A special rate of fare for the round trip has been granted, making the cost of the trip from New York City to Montreal and return $13.55. The secretary of the Association, Mr. John M. Partridge, Trust Building, Brooklyn, urges that all who intend to take the special train should notify him at once, in order that ample accommodations may be provided and proper assignments made.

Production of Copper, Zinc and Mica.

In a table issued by the United States Geological Service, giving the quantity and value of mineral products of the United States during the calender years 1885 to 1894, are the following figures relating to the production of copper, zinc and mica:

	Copper (*g*), value at N. Y. City, lbs.	Zinc, value at N. Y. City, lbs.	Mica, lbs.		Copper (*g*), value at N. Y. City, lbs.	Zinc, value at N. Y. City, lbs.	Mica, lbs.
1885—Quan.	170,962,607	40,688	92,000	1890—Quan.	265,115,133	63,683	60,000
Value	18,292,999	3,539,856	161,000	Value	30,848,797	6,266,407	75,000
1886—Quan.	161,235,381	42,641	40,000	1891—Quan.	295,812,076	80,873	75,000
Value	16,527,651	3,752,408	70,000	Value	38,455,300	8,033,700	100,000
1887—Quan.	185,227,331	50,340	70,000	1892—Quan.	353,275,742	87,260	75,000
Value	21,115,916	4,782,300	142,250	Value	37,977,142	8,027,920	100,000
1888—Quan.	231,270,622	55,903	48,000	1893—Quan.	337,416,848	78,832	66,071
Value	33,833,954	5,500,855	70,000	Value	32,054,601	6,306,560	88,920
1889 *a* Quan.	231,246,214	58,860	49,500	1894—Quan.	360,844,218	75,328	.....
Value	26,907,809	5,791,824	50,000	Value	33,141,142	5,288,026	52,388

An English Criticism.

To English engineers, says the London *Electrical Review*, it is refreshing to hear, from time to time, of the way our American cousins go to work. Mr. Stephens's description of an American station is highly amusing and instructive. It would appear that the majority of the buildings are fire-traps covering costly machinery, hot and dirty electric light and power stations, that consist of an aggregation of pitch roof, French roof and flat roof shanks, whose number and date of construction can only be guessed at by the different angles on the outside, and the color of the interior sheathing. The other extreme—although not so common, we are told—is the building of expensive brick chimneys, the greater proportion of a capital upon which the business in view would pay interest being sunk in these permanent investments, to the exclusion of purchase of economical machinery and intelligent service.

An Electric Railway Patent Suit.

A suit was commenced in the United States Circuit Court at Chicago, on Sept. 4, involving the ownership of the third rail contact system of electric traction employed on the Metropolitan Elevated Railway of Chicago. The complainant is the Siemens & Halske Electric Company, which claims that the above system as employed on the Metropolitan Railway is an infringement of a patent owned by it and issued to Ernest Siemens in 1885. This is the same system which was used on the Intramural Railway at the World's Fair, and the counsel for the plaintiff states that they did not attack the Intramural line because it was a World's Fair enterprise, and one which would be in use only a short time.

A Telephone Decision.

The United States Circuit Court of Appeals at Boston last week rendered a decision in favor of the American Bell Telephone Company, in the suit of the Western Union Telegraph Company for an accounting from the former under certain contracts made with respect to telephone patents transferred, a large sum being claimed for royalty. In the original suit the case was referred to the Hon. John Lowell as referee, whose report was in favor of the American Bell Company. The Western Union Company then applied to have the bill dismissed without prejudice, which was done by the United States Circuit Court. The present decision overrules this dismissal, on the grounds that the bill could not be dismissed at that stage of the case, and that the lower court, therefore, erred in its decision.

A Freight Electric Railway.

An electric railway is now being built between Youngstown and Lima, Ohio, especially for freight traffic, the bulk of which will be coal. The road will enter a coal field which has never been tapped, and containing about 5,000 acres of coal in three-feet veins. The Park & Falls Company, the name of the new line, expects to deliver its coal in Youngstown at $2 a ton, the price now paid for the coal in that city being from $3 to $3.50. The equipment of the line will consist of eight motor cars and about 100 coal gondolas; the motor cars will be of 100 hp, and each will haul 100 tons of coal at the rate of eight miles an hour. In addition to coal and passengers, the new line will carry farm produce, milk, express matter, etc., in fact, will do a general steam railway business.

Electric Signals at Sea.

Experiments are now under way at the Brooklyn Navy Yard on an electric system for signaling at sea. The principle consists in the arrangement of the alphabet in a monogram in a large frame. The frame is divided into 20 sections, each of which is connected with a separate electric circuit; by means of a keyboard, a combination of the various circuits of all the sections may be made, so that each of the letters of the alphabet may be produced. The same system was experimented with by the British admiralty several years ago, but the report on it was unfavorable. It has also been used in London to report results of elections.

Philadelphia Electric Railways.

The reports of the management of the several roads forming the Union Traction Company at Philadelphia, were published last week, from which we extract the following items: The fixed charges and rentals of the three companies are as follows: Philadelphia Traction Company, $1,389,457; Electric Traction, $924,669.73; People's Traction, $467,527.02; making a total of $2,781,671.75. Interest on new collateral trust bonds and the lease of the Philadelphia Traction Company amount, in addition, to $2,800,000, making the entire fixed charges of the Union Company $5,581,671.75. The cost of maintenance and operation of the three roads was $5,612,239.43, which brings the total expenditures up to $11,193,911.18, making a shortage of $1,719,336.24, which those interested state is fully expected to be made up by an increase in business. The passengers carried by the Philadelphia Traction Company during the year ending June 30, numbered 111,475,982, and by the Hestonville road 7,560,100. The length of the lines of the former is 203 miles, and of the latter 24.08 miles, the number of electric cars being 743 and 141 respectively; the latter road has in addition 691 horse and cable cars. On the Hestonville road there was one person killed and 31 injured, while 29 were killed and 250 injured on the Philadelphia Traction road.

Teaching Industrial Applications of Electricity.

In a paper read before the Springfield meeting of the Society for the Promotion of Engineering Education, Prof. G. W. D. Shepardson advises that after the engineering student has studied the physics of freshman and sophomore years and has learned something of the general principles and phenomena of electricity, he should be given some insight into the various directions in which electricity is being developed commercially. His plan is to take up the principal phenomena in about the same order as treated in the physics and to outline the ways in which these have been reduced to commercial stages, showing the steps of development, present state of the art and extent of use as indicated by the size, location and capital invested in plants. References are frequently given to direct students to further study of the various processes and appliances mentioned.

The aims of this introductory lecture course are to enlarge the vision of the student, to show that the two or three applications with which the student may have been acquainted previously are only a small part of the whole, to show that in every direction there has much been learned and much remains to be learned, that some fields are promising although apparently neglected, that the independent investigator finds many open doors for research and that new processes or industries may be developed after much labor and study. By such an introductory course the student can obtain a better idea of the opportunities before him, he is assisted to some extent in choosing the special line of work for which to prepare himself, and he can follow more intelligently the development of theory and practice in the remainder of his technical course. Prof. Shepardson has been developing this idea for four or five years and is convinced it is wise to give the students a brief bird's-eye view of the whole field of electrical engineering before going into details of any special developments.

Instruction in Mechanical Engineering.

In a paper on "A Course in Mechanical Engineering," read by Prof. H. W. Spangler before the Springfield meeting of the Society for the Promotion of Engineering Education, it is pointed out that the governing factors in determining the details of a course in mechanical engineering will be the personality of the responsible head of such a course, the fact that a large proportion of the mechanical engineering graduates are engaged in what may be called the minor industries, and the amount of preparation which can be obtained with intending students. The specialty of the instruction is of less moment than the laying of the foundation of a broad engineering education. The amount of preparation required should not exceed that obtainable at the best public schools, and the results to be sought are the education of the engineering common sense. The amount of time to be given the various subjects depends largely on the manner in which they are to be presented. It is generally not possible nor advisable to control collateral or preparatory work from the engineering department. It should be controlled so far, however, that the wasted time is reduced to a minimum.

A student should not be admitted simply because he is prepared in mathematics and physics to profit by the work, but he should have had a good education up to and including the necessary preparation.

In mathematics, if an applicant is prepared to or through plane trigonometry, ten hours per week for one year should be enough to complete the desired work.

In physics, with an elementary preparatory course, the work should be done in eight hours, exclusive of laboratory work. Prof. Spangler does not believe physics can be taught on the laboratory system. Laboratory work should be carried on to teach the student the handling of apparatus and the faculty of recording what he sees. Example should be taken from engineering appliances. If the usual physical experiments are made they are of little value to intending engineers.

Chemistry should be taught largely in the laboratory. Quantitative work should be the end sought. Engineering materials should be used for examples. Satisfactory work can be done in a surprisingly short time. Six to nine hours' laboratory work with two hours quiz and an occasional lecture should cover the ground.

In modern languages, if one or more is taught, the student should be taught to read with facility—nothing more. In English a large amount of individual instruction should be given, and the students made to do the work. This probably disposes of one half the classroom time available in a four-year undergraduate course.

In the engineering work, general divisions, such as drawing, applied statics, applied dynamics and specialties might be made. As to drawing, a student should first be taught how to draw, then how to draw things, then what to draw for engineering work, and finally to use his drawing as tools for further work. Here is the necessity for a certain amount of shop work, perhaps much less than we usually believe.

As to the second division, Rankine's "Applied Mechanics" is a good guide as to subjects but not very satisfactory as a text-book. In handling this work, concrete examples from mechanical engineering work should be largely used.

The third division contains such subjects as hydro, thermo, and electrodynamics. A large proportion of the laboratory work and some of the shop work will come under this head. In laboratory work it is not the number of experiments that are of value, but the amount of thinking the student has to do in connection with them is the thing that counts. Give him the problems, even the simplest, in the same form that they would be presented to you as engineers, and let him work them out in the same way that you would.

The fourth division is put under the head of specialties, the idea being that it is well that an exact careful study should be made of one line of mechanical engineering work, and it should be the one the instructor himself really knows, and it matters little whether it is pumping machinery, electrical or steam apparatus, or plants.

The course outlined is based on four years' work. If five are available it is advised that the lower years be strengthened; if less than four, nothing should be taken from the earlier work.

A Mayor and an Electric Leak.

A Waco, Texas, newspaper gives an account of an "electric leak," which is described as "pouring its deadly volts into a candy shop by way of a furnace pipe." The mayor of the city was called upon to investigate, and upon throwing a piece of paper against the pipe found that "sparks were emitted and the fire sputtered away until the paper was burned brown." The mayor also discovered that the entire building was charged, the upstairs being no exception, as the floor there was "so heavily charged that standing on both feet one could hardly endure the shock." The mayor is reported as fearing "horrible consequences," and will bring the matter of the leak before the City Council.

Trolley Funeral Trains.

The Calumet Electric Street Railway Company, of Chicago, continues to run funeral trains, and General Manager John Farsons believes that the conditions are such that funeral trolley trains over his lines will soon become desirable, not only from economical reasons, but also from their great convenience. The Calumet Electric Street Railway Company originated the idea of funeral trains and also claims to have been the first to get up the idea of trolley parties, which were conducted over its road last year.

When to Use Single, Double and Three-Phase Systems.

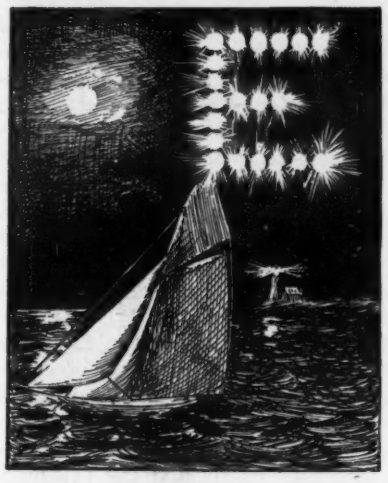
The well-known Swiss electrical engineer, Mr. C. E. L. Brown, in a recent interview in the London *Electrical Engineer*, states that he is governed by the following rule in the selection of the alternating system to be used in a particular case:

"In laying down plants where the main demand is for lighting with a few small motors as well, I always use single-phase; when the supply of power and light is approximately equal, I prefer the two-phase system, and, again, when the power supply much predominates, I always adopt three-phase."

Tesla Patents.

The Westinghouse Electric & Manufacturing Company has issued a circular reiterating its claims to the exclusive right, under Tesla patents, to manufacture and sell all forms of motors operated by currents of two, three or more phases, and all forms of single-phase motors where a second phase is induced so as to make the same a two-phase induction motor—notably the form used for the operation of fans. It states that suits are now pending against two manufacturing companies and numerous users of apparatus purchased from them and declares that the intention of the company is to enforce its exclusive right to manufacture and sell multiphase generators and motors, the two being used in combination as a system, such system being claimed to be covered by the patents of Nikola Tesla. In the first named suits a defense has been entered, and the court has limited the defendant to Oct. 7, 1895, in which to complete its testimony, so that a hearing may be had in the latter part of this year or the beginning of 1896.

An Electrical Sign.



ELECTRICITY has opened up a new field for advertisers. That is very apparent when we consider the large number of devices patented during the last few years. The very nature of an incandescent lamp makes it a prominent mark for the eye at night; hence, much ingenuity has been expended in arranging signs so that they might present a novel contrast to the surrounding blackness. Until the present time, however, nothing has been done other than to arrange the lamps into unique groups or make them spell out smart mottoes or statements. Such signs, when once assembled, become necessarily fixed, and after being long stationed on some prominent observation point, are apt to become somewhat irritating to the people they are meant to amuse and attract. The commercial consideration also seemed to be somewhat lost sight of, for it is obvious that a sign capable of being changed at will, would surely command greater patronage than one which gives but one reading.

The necessity for inventing a changeable incandescent lamp sign seems at last to have struck home, for one presenting some very novel features has been patented and erected at Manhattan Beach, L. I., where its operation has been witnessed by immense crowds during the past summer season. Its general features will be apparent from the illustrations. It is primarily an arch-like structure carrying on its upper part a solid bank of lamps. These lamps can be lighted singly from a switchboard, and any combination of letters or design effected. The arch is erected directly on the beach, almost within reach of the waves, and hence, on dark nights, has the intense blackness of the sea for a background.

The unique quality of this sign lies in the manner in which the

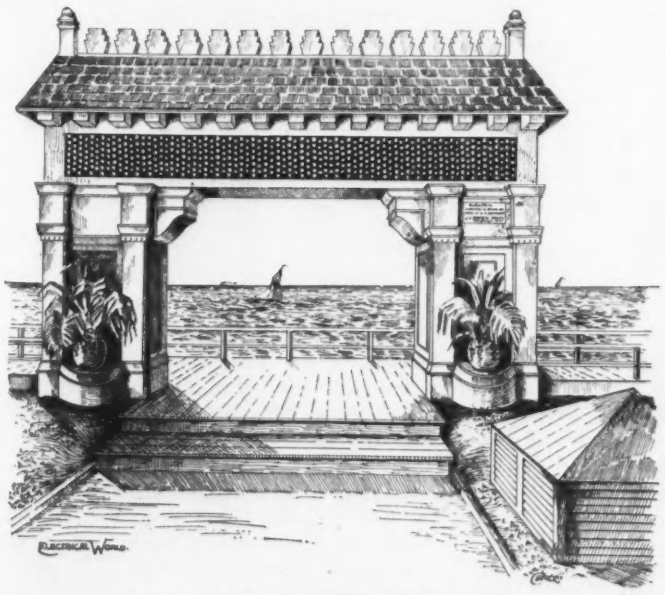


FIG. 1.—ELECTRIC SIGN STRUCTURE.

lamps are lighted. It is an extremely simple operation. There are in all 1,200 lamps packed closely together on the board. From each lamp a connecting wire leads to a switchboard having on it a corresponding number of terminal points arranged precisely in the manner of the lamps on the board. The bank of lamps is arrayed in perpendicular rows of sixes and sevens so that advantage might be taken of their fitting closely together. So also are the terminal points on the switchboard, which is made of fibre material. When the pencil is passed over the surface of the table a current is caused to flow through the lamps which are in direct connection with the points the pencil may happen to touch. It may be objected to at this point that the light of the lamps would also be extinguished the moment the pencil passed off the terminal points. But this is cared for by a patented arrangement of magnets which keeps up the connection until it is broken by a gang switch.

It will be seen from the above that any combination of letters can be effected. The operator at the table can "write" off a complete list of signs, each, perhaps, on a totally different subject. Therefore, for advertising purposes, this sign becomes very valuable. The interest of the spectator may not be allowed to flag, for any letter of a word may be written first. The middle letters, for instance, could

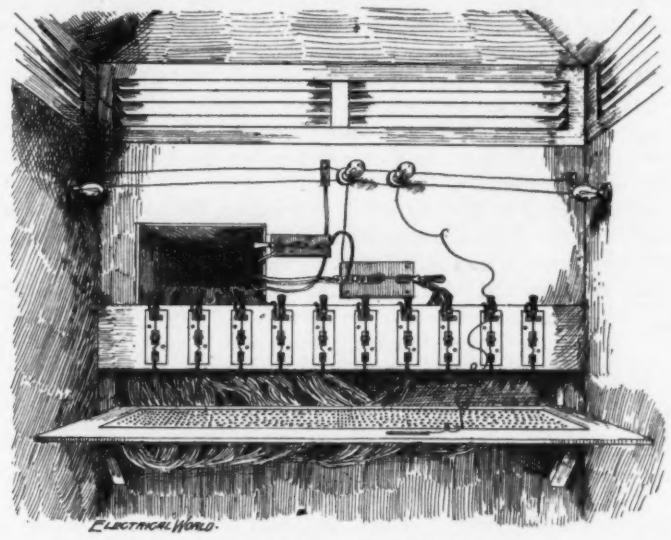


FIG. 2.—THE SWITCHBOARD.

be written first, as was in fact, done at Manhattan Beach, and curiosity excited as to what the complete arrangement would be. The method is to chalk off the intended word on the table and then follow the chalk line with the "pencil."

The installation at Manhattan is underground. The cupola or skylight leading to it will be seen just in front of the arch in the illustration. The lamps on the sign board are electrically separated into 11 divisions, each controlled by a gang switch. There is also a main switch, used for the purpose of darkening the whole sign when a sentence is to be changed. The letters of the sign are two feet in

FIG. 3.—SPELLING A LEGEND.

length, and as the lamp board is over 30 feet long the effectiveness of the arrangement can be imagined. The lamps are worked at 110-volts and the plant has a capacity of 1,000 amperes.

The sign is owned by the Electrical Advertising & Sign Company, composed of officers of the Long Island Railway Company. Mr. Charles M. Jacobs is president, and Mr. J. V. Davies is secretary and consulting engineer. The big sign which has for so long overlooked Madison Square has been worked under the auspices of this company, but it is said it is soon to disappear, its place to be taken by an immense sign of the kind just described, which will be 60 feet in length and each of its letters six feet long.

Magnetic Units.

The following two letters on the subject of magnetic units appear in the London *Electrician* of Aug. 23, the first being over the signature of Prof. S. P. Thompson, and the second over that of Mr. Sydney Evershed. We also add the editorial comment of the English journal on the letters.

It seems to me a much more important matter that electricians should understand clearly, and agree upon, the magnetic quantities for which units are to be chosen, than that they should try to settle names for units which may not be wanted. The need for names arises in order that the practical electricians may have convenient handles to denote things that they have to deal with, and are not specially wanted by abstract thinkers, to whom a symbol is more acceptable than a name. It would therefore seem to be a matter of elementary common sense that practical engineers should be asked what units they want to have defined.

Before trying to find or adapt any names, let us try to ascertain what units are wanted and agree upon their definitions. As a beginning permit me to make the following suggestions:

1. Most important of all, and first to claim attention and definition, is the quantity on which the operation of every dynamo, motor and transformer depends—namely, the quantity variously called the *magnetic flux*, the *total number of magnetic lines*, or the *total induction*. It is that for which I consistently use the symbol $\mathbf{N}$, and for which, in defiance of the recommendations of the Frankfort Conference (which decided that Greek letters should be reserved for angles, and for specific quantities like specific inductive capacity), M. Hospitalier uses the letter Φ. Who will suggest a definition for the unit of this quantity? The C.G.S. unit is *one line*. I know one accomplished designer of dynamos who regularly uses the terms *kilolines* and *megalines*, and finds them very handy.

2. The next thing that logically follows is the *density* of the first defined quantity; namely, that which goes by the names of *flux-density* or *number of lines per square-centimetre*, also unfortunately sometimes miscalled *the induction* (as though induction were not the operation of inducing, and already so defined by Faraday). Happily, whatever dispute we may have about the definition or denomination of this quantity, we all agree in using (though we quarrel over the fount of type to be used) for it the symbol $\mathbf{B}$, or $\mathbf{B}$, or $\mathfrak{B}$, or $\mathfrak{B}$

By proceeding in this order we avoid all academic fatuities as to whether we mean the flux in the air, or in iron, or anywhere else, or that part of it which would remain if the iron were removed. We must define it as that, whether in iron or in air, which, when cut by the moving conductor, induces therein electromotive force.

3. We then want a definition of that which when applied to a given configuration of magnetic matter, produces in it what we have already defined in (1); in other words, we want a definition of, and unit for expressing, that which goes by the names of *the line-integral of the magnetizing forces*, or of *the magnetomotive force*. Here we encounter the great four-pi difficulty. Unless we are prepared to take the heroic step of four-pi-by-tenning our ampere, and adopting a new unit of current, then we *must* either four-pi-by-ten our ampere-turns, or else shunt off the difficulty by one stage, namely, by declining to consider it until we pass to the next unit. *Magnetic-potential* would not be a bad term were it not that some sticklers for precision—notably my friend Prof. Ayrton—have for years, and with utmost consistency, declined to let us use the word *potential* (in its electrical application) for the whole line-integral of the electric forces in a circuit, and have persistently used it only for that part of the line-integral that lies outside the battery or dynamo. It has been in vain to point out that the P.D. is only an E.M.F.; it has been almost fruitless to abstain from using either of these hateful symbols. We have no recognized or universally adopted symbol for the whole, or total, or nett circuital electromotive force: even the sacred "E.M.F." is not reserved for this clear and unmistakable quantity. Magneticians have, therefore, the opportunity of setting a good example by fixing upon a clear, good definition of a *circuital* quantity, the separate parts of which can be separately defined *pro re nata*.

4. Just as (2) follows from (1) by dividing it by an area, so the fourth quantity requiring definition can be defined as a sequence from (3), but in this case by dividing by a length. The fall of magnetic potential per unit of length along the path will give us a definition of the quantity variously called *magnetic intensity*, *magnetic field*, or *magnetic force at a point*, and symbolized by $\mathbf{H}$, or $\mathbf{H}$, or $\mathfrak{H}$, or $\mathfrak{H}$. If we have, however, evaded the four-pi difficulty, and taken ampere-turns for (3), then its fall per unit of length will not be $\mathbf{H}$, but $\mathbf{H}$ ten-over-four-pied.

5. When (1) and (3) shall have been defined, we then want a definition of the quantity which intervenes in the relation between them as applied to any magnetic mass of given circuital configuration. In other words, we want a definition of *magnetic resistance*, or *reluctance*, or else of its reciprocal *magnetic conductance* or *permeance*. That such permeance or reluctance does in some kinds of magnetic media vary with the degree to which the flux-density has been pushed is quite immaterial to the need of definition and of a unit. One does not hesitate to define the specific refrangibility of a material because it depends upon the particular wave length of light that is being used. If we decide to define the *permeance* as the ratio of (1) to (3), or the *reluctance* as the ratio of (3) to (1), we shall still require tables giving statistical information as to the dependence of the specific permeance or specific reluctance upon the flux-density. Further, if we have shunted the four-pi difficulty from the preceding stages, we must finally face it now.

6. It will then only remain to define the specific quantity *permeability*, or *reluctivity*, as the case may be, by dividing (5) by a volume. Happily, we are all agreed as to the symbol μ, in case *permeability* is chosen instead of *reluctivity*.

Will not some constructive engineers—Mr. Esson, Mr. Ravenshaw, Mr. Sydney Evershed, Mr. Mordey, or Mr. Anderson—tell us what things they think most important to be defined?

I see the scienticulists of the B.A. are at it again, and threaten us with a new series of units and names, while the original scienticulist (it is his own word) actually proposes to abolish 4π and leave us poor practicians to wallow in a sea of curling waves.

Lend me a little of your space to beg the B.A folk, before going to work, to ask themselves what new units are wanted and who will use them? Let me tell them it is the practician who uses units with names to them, and at the present moment he wants a name for the unit of total magnetic induction and unit total magnetic force. He also needs—but not very badly—a name for unit self-induction, "henry" not having penetrated this side of the Atlantic.

Mr. Vignoles and I long ago suggested "thom" as a name for one "line of force" and "gauss" for one thom per square centimetre.

We very soon dropped the *gauss*, finding the *thom* alone was really useful in everyday work, and at Woodfield Works no one ever talks about lines of force. We think of the "*thom*" as a unit of squirming in the ether, and have consequently banished forever all the paridoxical phenomena for which the line of force has been mainly responsible.

Now, I do not expect the B.A. to adopt the thom; it will not be easy to find a better word but by all means let the B.A. endeavor to invent an equally good name itself. Only for Heaven's sake give us a word of one syllable. By the way, if it *must* be a dead and distinguished physicist, why not Thales—pronounced, of course, to rhyme with Wales.

"Practicians" who may have been sufficiently courageous to glance at and sufficiently persevering to master the contents of Dr. Lodge's report to the Electrical Standards Committee, which we published in our issue of Aug. 2, will, we think, agree with the opinions expressed by Prof. Silvanus Thompson with characteristic lucidity and point, in his letter to be found this week in our "Correspondence" columns. Prof. Thompson's dictum that the adoption of units likely to be used by practical electrical engineers is more important than names, and a common agreement between theorists and "practicians" more important than a scientifically ideal system, is instinct, to use his own phrase, with "elementary common sense." To us, the hankering after names evinced by so many on either side of the Atlantic is somewhat of a puzzle. $\mathbf{N}=1{,}000{,}000$ conveys, one would have thought, quite as much as $\mathbf{N}=1{,}000{,}000$ "thoms"; and there is no need to remember which mutilated surname we ought to apply. However, be this as it may, we trust dynamo designers and others will follow Prof. Thompson's advice, and either discuss the many *pros* and *cons* of this question in the columns of the technical journals, or put in an appearance next month at the British Association, and take part in the proposed discussion. Above all things let us hasten slowly, but adhere doggedly to whatever is once definitely decided on in the matter of magnetic symbols, nomenclature, units, and definitions. Practical men cannot be forever discarding what is good enough for what is better still.

ANNUAL MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE Springfield meeting of the American Association for the Advancement of Science seems to have fulfilled expectations in everything except attendance of members, which was below 400. Of the 207 papers read, 42 were on chemistry and 34 on physics.

The chemical papers included some notable ones in the way of electrometallurgy, especially a portion of the annual address of Dr. Wm. McMurtrie, vice-president of the section, and that of P. de Chalmot and T. S. Morehead on calcium carbide. R. P. Williams's account of the new electrical process of making white lead was given to the Chemical Society.

The address of Wm. McMurtrie, Ph.D., vice-president of the chemical section, on "The Relations of the Industries to the Advancement of Chemical Science," gave an interesting account of the mutual help which theory and practice derive from each ; many instances were noted where pure science has been promoted by the knowledge and experience gained in industrial operations. The interdependence of the sciences was also illustrated by pointing out the advantage of combining the qualifications of an engineer with those of a chemist.

The following paragraphs are of sufficient interest to our readers to be transcribed entire:

"In no direction has the application of the methods in the larger way, either in the laboratory or in the works, given richer yields in new material than in the varied uses of the electric current in chemical work. It has led to the production of new compounds or has increased the means for production of old ones, and through it additions are constantly being made to the store of material of such compositions and properties that they must inevitably lead to further new discoveries on the establishment of new principles or laws. It has added greatly to our knowledge of the reactions of oxidation and reduction, and has made new applications of those phenomena possible. In this connection we may refer to the processes of Hoepfner and of Siemens and Halske for the extraction of copper from its solutions, whereby as the metal is removed from its solution at the cathode, the reduced salts are oxidized at the anode, and the solutions, thus brought to the higher state of oxidation, are ready for use on new portions of ore. Similar reactions occur in the new process of Löwenherz for the production of sodium persulphate, a compound new to chemistry and resulting from the application of electricity on a scale more extended than is usually employed for laboratory work. Sulphuric acid and sodium sulphate solutions, separated by a porous diaphragm, are electrolyzed with the anode immersed in the sodium sulphate. The compound is comparatively unstable, yielding up to oxygen with the production of acid sodium sulphate. And since this latter may readily be neutralized by sodium carbonate, the new compound is recommended for all uses to which oxidation may be applied.

"With the production of hypochlorites and the chlorates, we are already familiar. It grows rapidly with the cheapening of artificial power, or the utilization of natural power, until eventually the world's demand for them must be covered by materials from this source. The reaction necessary to this is further utilized in the production of such compounds as chloral, iodized phenol and other similar substances.

"In the field of reductions reference may with interest be made to the late discoveries of Gattermann and the color works of Fr. Bayer & Co., that electrolysis is readily applied to the production of a large number of compounds not heretofore produced technically, but for which technical uses constantly exist. Their earlier discovery of the application of electrolysis to the reduction of nitrobenzol to amido-phenol with intermediate production of phenylhydroxylamin finds wider application than they at first supposed, and will doubtless constitute the starting point of a new line of synthesis of the carbon compounds. This reaction is similar to that of zinc dust in alizarin solution, preferably in alcohol containing calcium chloride whereby, as noticed by Wohl and Bamberger, phenylhydroxylamin is produced instead of the anilin produced by the reduction with acetic acid and iron.

"The electrical smelting furnace has opened up a wide field of experiment and investigation, as fascinating as it is new, and it is to be expected that many additions will be made to the list of new substances through its use. The increased production of chromium and the crystallization of carbon by Moissan, the production of carborundum by Acheson, the productions of carbids by Moissan, Willson, Borcher and others, are of great interest from both the technical and scientific side. Whether the calcium carbid, which has been so much discussed, and seems such a valuable material for the production of acetylene, will at once take and hold the high position assigned to it by its inventors, is still an open question. But whether it shall find extended application in the industries or not, whether it will prove too expensive to compete with benzol as an enricher of illuminating gas, or as a raw material for the synthesis of alcohol or other substances in a commercial way, it will serve as a convenient and sufficiently inexpensive source of acetylene for experimental purposes, and it will therefore without doubt still become the starting point for many valuable investigations. Nikodem Caro has already applied the method of Berthelot to the synthesis of alcohol with acetylene liberated from calcium carbid, and shown that the yields are so far from the theoretical amounts that immediate application in this direction is at least doubtful."

The vice-presidential address before the section of Mechanical Science and Engineering was delivered by Mr. William Kent, his subject being "The Relation of Engineering to Economics." Mr. Kent compared the definitions of political economy and engineering and found that they are closely connected, and then proceeded to consider the engineer's share in the production of wealth. Coal in Great Britain alone does the work of one hundred million of men, and the immensity of its utilization as a source of energy is illustrated by the statement that if 1 per cent. of the consumption of fuel of all kinds in the United States were saved, it would be equal to 2,300,000 pounds of coal per year; and to effect this saving is the work of the engineer. All the various manners in which engineering has resulted in the production of wealth were reviewed, and the conclusion arrived at that engineering is the chief factor. It was predicted that as engineering has caused men to leave the farm and seek the cities, because in the cities they can grow rich faster, so again, engineering through rapid transit, electric cars and the like, is making it possible for those men who work in the cities to live in the suburbs and bring up their families with all the advantages of city and country combined. The influence of the bicycle was dwelt upon, and its result predicted to be the building up of an athletic and healthy race of men and women and the causing of good roads to be built from one end of the country to the other. The statement of Mr. Hewitt is endorsed to the effect that the wage earner will become a stockholder in the corporation for which he works, and labor will hire capital instead of capital hiring labor. Referring to the prediction of a great social uprising in the future, the world, it is stated, will live through it; the social order, as of old, will be restored, and the present relations of capital and labor will not be changed, except as by gradual and necessary evolution, due to engineering more largely than to any other one cause, capital and labor becoming merged by the laborers becoming capitalists. This will be the crowning triumph of engineering, by which the increase of wealth is caused which enables the laborer to become a capitalist. Then the political economists may meet together and discuss the improved social order, burn their old books, and erect a monument to the one man of all others who contributed the means for obtaining the wealth of nations—James Watt, the engineer.

In the Physics Society several valuable papers on color were read by Wm. Hallock, J. H. Pillsbury, Frank P. Whitman, R. Gordon and E. R. van Nordroff, and resolutions were adopted looking toward a fixing of the standard of color.

Prof. Wm. A. Rogers read a paper on "Examination of the State-

ment of Maxwell, that All Heat Is of the Same Kind." Rogers' experiments with his delicate interferential comparer led him to question whether heat by radiation, conduction and connection does not differ in kind. Another matter determined by the use of the same instrument is that the length of the standard meter has not varied as much as one micron within the last 15 years. The length of the meter is determined as 39.37015 inches.

Frank H. Bigelow read a paper on "Solar Magnetic Radiation and Weather Forecasts." Some of his inferences, if established by sufficient proof, are among the most remarkable of recent scientific discoveries. He maintains that the magnetic radiations demonstrate the existence of an earth-crust about 800 miles in diameter, and that the sun has also a crust, thus controverting current theories that the sun is wholly vaporous or fluid. He also anticipates that his method will lead to means of forecasting the general seasonal climatic conditions many years in advance.

Prof. H. S. Carhart read a paper on "An Experimental Investigation of the Rotary Field."

Prof. C. D. Childs in a paper on "Phenomena of Electric Waves Analagous to Those of Light with a Diffraction Grating," gave a preliminary report of work still in progress. The work was undertaken for the purpose of testing various methods of showing the Hertz effect in order to find one practical for lecture purposes. Though the work is still in an unfinished condition, not only has this object been accomplished, but also an effect has been observed corresponding to the effect with the diffraction grating in light. It is believed that this has not before been observed.

The first method tried was one developed by Lodge (the work of Hertz and some of his successors). He found that the electric resistance of a tube of iron filings when subjected to electric waves was decreased. His idea was that the film of dielectric separating the filings was broken down by the waves so that better connection was made between the filings. The resistance could be again increased by a mechanical jar. This was found to be a delicate but very irregular method.

Aschkmass (*Wiedermann's Annalen*, Vol. 54, p. 103) has claimed that the resistance of tinfoil also decreased when subjected to electric waves. Experiments made seem to show that there is no change in the resistance of the tinfoil itself, but that there may be a change of contact between strips of tinfoil when arranged somewhat as they would be for a bolometer. This variation may be made much more regular than the change of resistance of iron filings. The method found most practical for this work was to fasten a piece of tinfoil about 2.5 cm square with a piece of wood with a thin layer of beeswax and then cut it into strips about one-half mm wide, leaving connections alternately at the ends, so that the current would be obliged to travel back and forth through the tinfoil. This was placed at the focus of a parabolic mirror and was connected so as to be one arm of a Wheatstone bridge,

An exciter was constructed after the method used by Righi (*Nuovo Cimento*, series 4, Vol. 1, p. 25). By this means all the usual experiments with electric waves can be shown qualitatively and furthermore quantitative measurements may be made more or less accurately, since the greater the intensity of the waves, the greater the change of resistance of the tinfoil. By this means the effect with the diffraction grating was observed. The grating was made by fastening strips of tin on a wooden frame. With two different gratings thus made the wave length was determined to be five cm for the waves with which the work has thus far been done. The waves were found to be this length also by a method of interference used by Righi. The method may also be used for detecting the propagation of waves along wires. If this method proves to be as successful as it promises to be from the preliminary work, it will not only be one of great sensitiveness, but also of considerable accuracy for quantitative work.

An interesting paper was read by Prof. M. I. Pupin, of Columbia College, on "The Flow of Alternating Current in Cables." The determination of the distribution of current in a telephone line has been treated theoretically by Kelvin and Heaviside. They, however, did not take into account the effect of the receiving and transmitting apparatus. The equation of condition expressing the law is the same as that of a vibrating cord. La Grange solved this equation a hundred years ago, but the solution could not be used directly because of the transmitting and receiving instruments. Pupin supplied the missing terms, and verified experimentally the equation he had obtained by theory.

Prof. Pupin also read a paper on "The Most General Relation between Electric and Magnetic Forces and Their Displacements." He says that the Maxwellian theory of electricity includes that of light also. It rests on two experimental laws and a hypothesis that the electric current can exist in insulators as well as in conductors; and that E. M. F. can be induced in insulators as well as conductors. It explains all the various phenomena of light without added hypotheses, which no other theory does. But it is necessary to have then an additional third law, which Pupin deduced directly from the other two.

Prof. M. A. Veeder submitted a paper on "Magnetic Storms and Sunspots," which describes a method of examining into the connection of these phenomena, the data being obtained from tracings reported by the declaration magnetograph at the Naval Observatory at Washington. The object of the paper is rather to furnish data, authentic beyond dispute, than a comprehensiveness with respect to the respective details, and contains no discussion in regard to the actual relation of the phenomenon.

The mechanical section had only six papers, and adjourned on Friday to give time to the Society for Promoting Engineering Education. A popular paper on "The Economics of Engineering Public Works," by H. N. Ogden, was read by the secretary. It called attention to the waste involved in laying parallel systems of water pipes, gas or electric pipes, and repeatedly tearing up pavements for this purpose when one system would suffice. Also the unnecessary and wasteful paralleling of railways, etc., and duplication of electric machinery. In discussing the paper, Prof. Corthell expressed disapproval of the proposition to be voted on at the coming election in New York, that the State should expend $9,000,000 on canals, because he thinks no real benefit would be derived, inasmuch as the railways transport merchandise already so low and the money spent on canals would not secure any further reduction, but would be simply wasted.

Among the other papers read before the section were one detailing experiments on the flow of steam and comparison of the result with Napier's formula, by J. J. Flather, and another on the perfect screw problem, by Wm. A. Rogers.

The Association will meet next year at Buffalo, Monday, Aug. 24, being a new departure in the day of the week. The president-elect, Edward D. Cope, of Philadelphia, is renowned as a paleontologist. The president of the physics section is Carl Leo Mees, and the secreary, Frank P. Whitney; Frank O. Marvin is president of the mechanical and engineering section, and John Galbraith, secretary.

The True Place of Drawing and Shop Work in Engineering Schools.

In a paper under the above caption read at the Springfield meeting of the Society for the Promotion of Engineering Education, Prof. C. H. Benjamin holds that drawing and shop work are of value in two ways: as educational factors in the development of the mind and as a part of the practical training of the engineer.

The educational side should be made prominent in the high school or manual training school, while practical considerations should shape the instruction in the technical school.

The experience of designers and manufacturers of machinery has shown the most economical methods to be used in drawing and machine work, and these are the methods which should be taught in the school.

Free hand drawing should have a prominent place in the course, being very important to the engineer as a means of expressing his ideas to customers and to his subordinates.

In mechanical drawing the practice of the leading shops of the country should be followed. The drawing office, in itself, and in its relations to the shop, should be like a real office in its methods and in its routine.

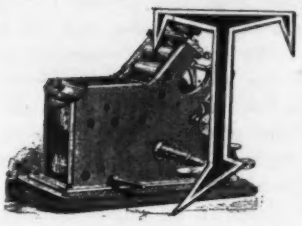
Manual training should be a condition of admission, and any student not having it should be required to make it up at summer school or otherwise.

In the shop, as in the drawing office, the relations between the different departments, as moulding, pattern making, etc., should be maintained as in a real shop, and real machinery should be manufactured, with the same attention to hours of labor, cost of material, and to the discipline and routine, as if the products were made to sell.

The argument for a real shop instead of a toy shop is not based on economical considerations, but on the fact that only by building complete machines can the students be taught constructive design at the same time that he learns shop processes.

The Invention of the Electromagnetic Telegraph—IV.*

BY RUDOLF PETSCH.



THE apparatus of Schilling was exhibited at the meeting of Natural Philosophers at Bonn, on Sept. 23, 1895, and while on his way to this meeting Baron Schilling von Carnnstadt visited Gauss and Weber in Göttingen. When Prof. Weber followed him to Bonn a little later he took with him an interesting letter[19] from Gauss to Schilling, concerning the electromagnetic telegraph, the most interesting part of which we here reproduce:

"The departure of our friend Weber for Bonn gives me occasion to tell you again what a great pleasure it was for me to renew your acquaintance, and to converse with you on so many scientific subjects. Nothing could be more agreeable to me than to have you take up your residence for some time in Göttingen. Whatever advantages large places may possess, as regards other enjoyments, yet you can find nowhere else a greater sympathy for those efforts which are directed toward wrestling Nature's secrets from her.

"I wonder where the electromagnetic telegraph will first be used practically *on a large scale*. Sooner or later this will certainly take place, whenever people see that it can be constructed incomparably more cheaply than optical telegraphs. Telegraphing by the use of induction requires only a *simple* galvanic chain, and I think that one could bring it so far as to be able to transmit eight to ten letters a minute. According to a computation which I had occasion to make to-day, it would be necessary, *in order to connect Leipzig and Dresden in this manner without an intermediate station* to use copper wire only 1.6 mm thick; in fact, even thinner, if the electromotive force and the multiplier be made more powerful. Where it is desired to undergo the greater cost of a manifold chain (according to your idea of seven wires), your plan will, on the one side, attain a somewhat greater rapidity, and, on the other hand, will be more independent of particular intelligence on the part of employees. I think, however, that the latter advantage could also be acquired to a pretty high degree in the operation of the induction system, by the use of a machine, whose main features I have recently thought out."

Guided by these inventions and contrivances of Gauss and Weber, Prof. Carl August Steinheil constructed, in 1836, at Munich (Fig. 6), his apparatus which was further developed in several directions. First of all, he altered the *receiver* in such a manner that it made *the incoming telegraphic characters perceptible to the ear*, and was able besides *to write them down permanently*. For this purpose he also brought the magneto-electric induction machine, used as a *current generator*, to *a very efficient form*. Furthermore, Steinheil put up a line in 1837 between Munich and the observatory at Bogenhausen, exclusively for telegraphic purposes, which considerably surpassed all previous ones in length. In the following year, moreover, by *his discovery that currents could return through the earth*, he reduced the number of conducting wires necessary to one.

GAUSS.

WEBER.

However, this telegraph, for some incomprehensible reason, did not come into further use, although it so immensely surpassed all previous arrangements in completeness. The first public notices of Steinheil's telegraphic labors appear in the *Neue Würzburger Zeitung* of June 30, 1837, and the *Augsburger Allgemeine Zeitung* of July 23, 1837. Our Figs. 7 and 8 show the essential arrangement of the apparatus, the writing-machine[20] and the alphabetic characters chosen.

The induction apparatus used as a source of current consisted of 17 horseshoes weighing 60 pounds, its lifting power being about 300 pounds. The multiplier coils, which were movable before the poles of the magnet, had 15,000 turns of wire weighing 1.053 grams per meter. In order to be able to move the inductor easily it was balanced on a bar, on the other end of which were two balls for counter weights.

Inside the multiplier windings of the receiver were two magnets in line with each other, movable on vertical axes, and carrying brass rods on the ends turned toward each other. The rods served to strike bells, as well as to fix the writing which consisted of dots. For the latter purpose a paper strip moved uniformly before the points of the receiver, being wound off one cylinder and on to another by means of clockwork. By the aid of the 30 characters of the alphabet, intelligence could be transmitted with considerable rapidity, 92 words requiring about a quarter of an hour.[21]

In the meantime, the Schilling telegraphic apparatus, which had already been shown at the Natural Philosophers' convention in Bonn, Sept. 23, 1835, was taken to England by William Fothergill Cooke, and there given practical shape by him and Wheatstone. It happened, namely, that Privy Councillor of State Muncke had shown a model of this telegraph at one of his academic lectures in Heidelberg. Cooke, who was there at the time, but who had until then never occupied himself with electricity, and not even with physics, attended Muncke's lecture on March 6 1836, on account of this exhibition. Here he witnessed telegraphing, saw how useful it would be in the tunnels of the railways which were spreading over England at the time, and immediately resolved to give up the anatomical work which had hitherto occupied his attention, have such a telegraphic apparatus made for him and introduce it into England. On April 22, 1836, he arrived in London with a copy of Muncke's apparatus which had been made with the greatest haste, partly in Heidelberg and partly in Frankfort-on-Main. It had three needles and six wires, and he had constructed for it an alarm mechanism which was operated by the attraction of an electromagnet. From this there was developed the five-needle telegraph designed by Cooke and Wheatstone together. On Nov. 19, 1837, the two made a formal business contract, and on Dec. 12 they handed in the description of their five-needle telegraph with six conductors to the patent office. From this five-needle telegraph, (Fig. 9), there was afterwards developed the one-needle telegraph.

In 1838, Wheatstone, in speaking of the matter, remarked[22] that he had already gathered the names of 62 physicists who claimed to have invented the electromagnetic telegraph. Among these names, of course, was that of Morse, who, to be sure, was not a physicist, but a painter (professor of the literature of the arts of design).

In order to perfect himself as a painter, Samuel Finley Breese Morse had twice been in Europe, from 1811 to 1815, and from 1829 to 1832. It is not at all impossible that here he may have heard of the Sömmering telegraph, and also of the other efforts to contrive an electrical system of communication. At any rate, it is certain that in 1832, on his return from Havre to New York, on the ship *Sully* he made the acquaintance of Dr. Charles T. Jackson, of Boston, who had studied the nature of electromagnetism with Prof. Pouillet at the Sorbonne in Paris, and who had with him a galvanic battery, as well as an electromagnet bought of Pixii. Jackson entertained the company repeatedly with electrical experiments, in which he pointed out the possibility of using electricity for signaling and telegraphing. The Russian, I. Hamel, in his report on the origin of the electromagnetic telegraph, given to the Academy of Sciences in St. Petersburg, Dec. 23, 1859, says, among other things, that he had himself seen rough sketches of Dr. Jackson's telegraphic ideas in the latter's pocket book. Even if it be conceded that it was not Jackson, extremely well versed in the

* Continued from page 260.

[19] I. Hamel, "Die Enstehung der Galvanischen und Electromag. Telegraphie."

[20] The original is in the possession of the Royal Bavarian General Conservatory of Scientific Collections in Munich.

[21] Dingler's Journ., Vol. LXVII , page 390.

[22] Moigno, "Telegr. Electr.," p. 75, 2d edition, 1852.

sciences, but Morse, the painter, who on this occasion gave the first suggestion for these plans, the fact is certain that the ideas then expressed differed very essentially from those later carried out.

Steinheil.

Although it was endeavored, from the beginning, to have the intelligence transmitted by the galvanic current appear in visible, permanent characters on the paper, this object, at first, was to be

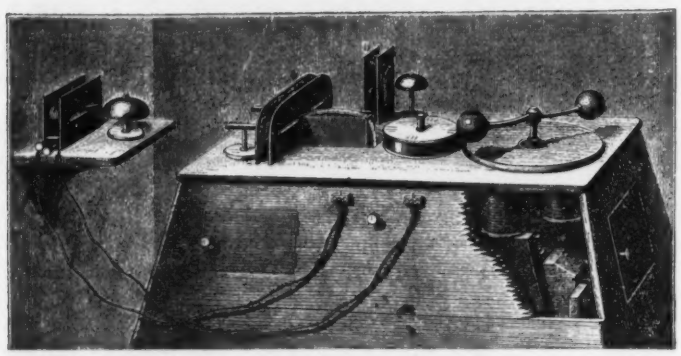
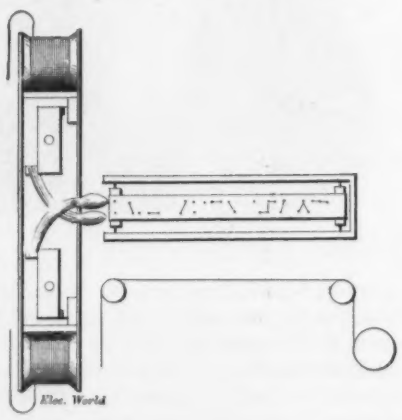


Fig. 6.—Steinheil's Telegraph.

accomplished electrochemically, or by burning groups of holes in the paper.[23] But at that time neither Jackson nor Morse had designed a *finished* plan for a telegraph. The former apparently allowed the matter to drop entirely, while in Morse's mind the idea remained alive.

It was only five years later, and after Schilling, in Russia, had meanwhile exhibited a model of his thoroughly practical plans, after Gauss and Weber, as well as Steinheil, had really carried out their inventions, and, finally, after Cooke and Wheatstone, in England, had put up well working telegraphs on the Schilling model, that Morse succeeded, in the middle of 1837, with the scientific and active aid of Leonard Gale, professor of chemistry, in finishing his first apparatus, which, however, in its incomplete form, gave little prospect of coming into extended use.



It will be necessary, for the purposes of our investigation, to briefly notice the construction of this apparatus. Above a uniformly moving strip of paper a wooden pendulum was hung so that a pencil (or pen filled with color) fastened to its end was in constant contact with the paper, and drew a straight line on the latter as long as the pendulum was at rest. Beside this pendulum was an electromagnet, whose windings were in circuit with the line coming from the distant station, and which attracted an armature fastened to the pendulum, as often as the circuit was closed at the other end and a galvanic current was led into the line. The pendulum was thereby moved in a direction at right angles to the motion of the paper, and the pencil made a zigzag line whose form varied with the number and duration of the "makes" in the circuit. With ten such characters—corresponding to the nine figures and nought—Morse put together not words, but only numbers.[24] Every word had, therefore, to be numbered. This was done in an alphabetically arranged dictionary, in which every word to be signaled, and its corresponding number, had to be looked up. By means of an eleventh character, notice was given that the numerical characters immediately following were to represent not words, but real numbers. For these characters Morse had constructed types with appropriately formed projections. He made and broke the circuit by means of an arrangement (port-rule) carrying the telegram, set in type, under a lever which closed the circuit as often as it was lifted by the projections on the types.

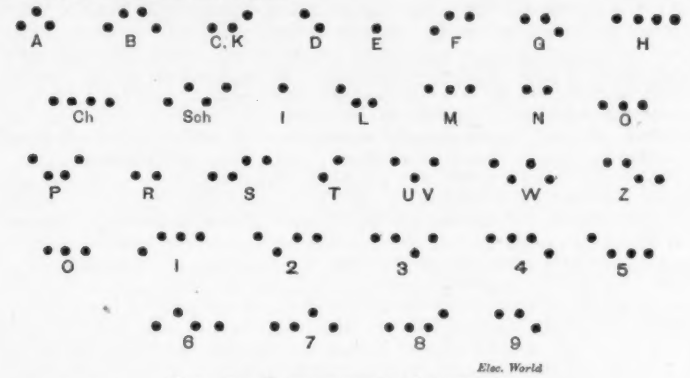


Fig. 8.—Steinheil's Alphabet.

When, at the end of August, 1837, there appeared in a New York daily paper the notice of Steinheil's telegraphic system, taken from the *Neue Würzburger Zeitung*, another journal hastened to point out, *very unjustly*, that the electric telegraph was an American invention, the idea and design of which were due to Prof. Morse. Having their attention attracted by this notice, many persons called on Morse, in order to see his apparatus. Among them was the Englishman, Dr. Daubeny, professor at the University of Oxford, who was traveling in America at the time, and also the engineer, Alfred Vail. The latter placed his financial and technical resources at Morse's disposal, and, in consequence, played a leading part in the efforts made to fit out and perfect the apparatus for an electromagnetic telegraph.

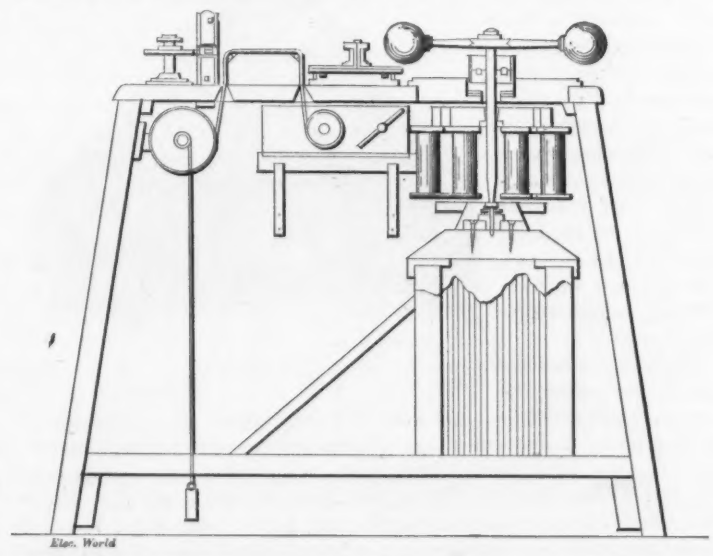


Fig. 7.—Steinheil's Telegraph.

"On Sept. 2, 1837, Morse's machine would write nothing properly. Pains were taken to make it work, and two days later,

[23] "Zeitschrift des Deutsch-Osterreichischen Telegraphen-Vereins," Volume I, No. VIII.

[24] I. Hamel, "Die Entstehung der Galvanischen und Electromagnetischen Telegraphie," St. Petersburg, 1883.

Sept. 4, a figure, representing a short sentence of five words and two numbers, was successfully drawn on a paper strip. For this, not less than 124 oblique and 19 straight horizontal strokes were necessary. The figure, looking like saw teeth, expressed the following numbers: 215. 36, 2, 58, 112, 04 01837 On looking these numbers up in the key, it was found that they meant: Successful experiment with telegraph, Sept 4, 1837.''[25]

''Even if, however, this telegraph of 1837 had been Morse's exclusive property[26], that is to say, if Gale and Vail had not materially aided Morse in his efforts, and leaving out of consideration what had been done in Europe in 1837 and before that time, Morse's invention could even then not be regarded as complete in that year, for in September, 1837, his telegraph was not yet capable of practical operation, by far. Besides this, it must naturally not be overlooked that his telegraph of 1837 does not coincide with the 'Morse telegraph,' which later went into such extended use.''

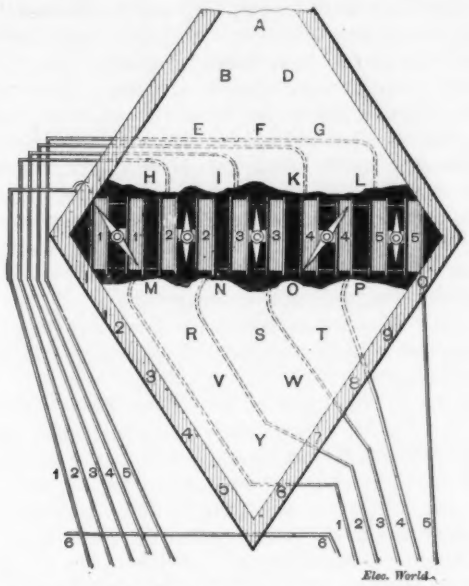


FIG. 9.—COOKE AND WHEATSTONE'S TELEGRAPH.

It was only in the course of several years, at the Speedwell Iron Works of Stephen Vail & Son, the father and brother of Alfred, near Morristown, New Jersey, and elsewhere, that the apparatus was essentially improved and given the form in which on account of its simplicity and efficiency it was destined to surpass all previous telegraphs. The application for a patent on the apparatus of 1837 was taken back by Morse, so as not to be hindered in the acquiring of European patents. In the patent of June 20, 1840, which Morse later took out in the United States, the pendulum of the first apparatus was replaced by the writing lever with rounded steel point, and a key was used for a transmitter instead of the ''port-rule.''

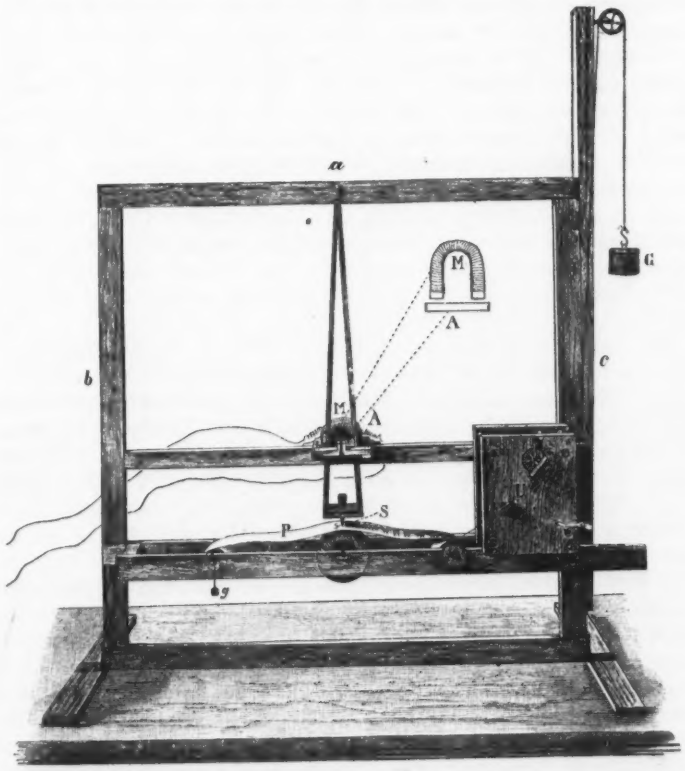


FIG. 10.--EARLY MORSE TELEGRAPH.

Our illustrations (Fig. 10 and 11) show the model of the oldest Morse apparatus of 1837 as well as the model of the apparatus for which Mr. Samuel F. B Morse was awarded a new patent by the United States Patent Office on April 11, 1846.

In this second patent Mr. Morse also laid claim to the construction of a transferring arrangement for increasing the efficiency of the telegraph. The principle of the relay used for this purpose had, however, been first declared by Wheatstone, in England, in his patent of June 12, 1837.

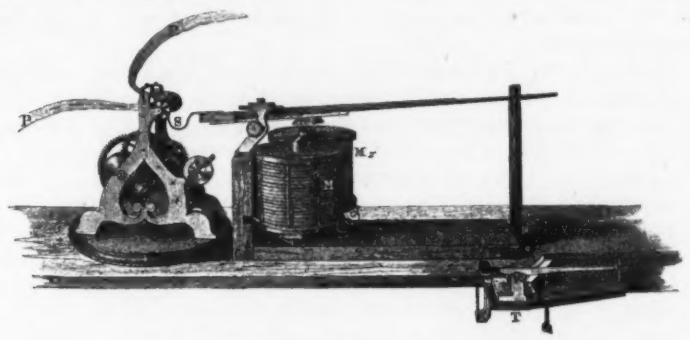


FIG. 11.—EARLY MORSE TELEGRAPH.

We come now to the conclusion of our investigation. As an unassailable result of the latter we must most resolutely deny the assertion made by Morse in one of his letters that he was the first designer and inventor of the electromagnetic telegraph, and that all telegraphs in Europe, without exception, were invented later than his. We have seen, on the contrary, that telegraphy, more, perhaps, than any other branch of technology, resting on a scientific basis, owes its rise and development to its present high d gree of perfection to the collaboration of prominent men of all civilized nations, and that it may rightfully be regarded as the result of a series of international experiments. We have particularly demonstrated that it was the important discoveries of Oerstedt[27] and Schweigger which made it possible for Ampère to *express the first idea* for an electromagnetic telegraph; that *the first proposition for an electromagnetic apparatus*, which was not brought into use, but which was *undoubtedly practicable*, came from the Russian, Baron *Schilling*, and that the German professors *Gauss and Weber* were finally the *inventors*, who *for the first time carried out such a telegraph, and used it to transmit intelligence to a distance.* The first telegraph systems for operating railways, and for public communication were built in England by Cooke and Wheatstone as early as 1840, as soon as they had succeeded in making decided progress toward simplicity of arrangement by the construction of their one-needle and double-needle apparatus. In America, on the other hand, the first telegraph system of Morse and his co-laborers—from Baltimore to Washington—could only be begun in 1843; and, moreover, on account of hindrances in construction, the first telegram on this line was sent off only on May 24, 1844.

Although, according to this, Morse cannot claim priority in the invention of the electromagnetic telegraph for himself as for America in general, it must be conceded, on the other hand, that the apparatus patented by him occupies a prominent position in telegraphy, a circumstance which will not soon allow the name of its originator to sink into oblivion.

One Way of Doubling the Capacity of a Station.

The managers of the municipal station at Bradford, Eng., recently had to increase the capacity of the station to meet the demand, the system used being a continuous-current three-wire one, with 115 volts on each side; they accomplished it by the unique plan of requiring all new consumers to use 230-volt lamps connected temporarily with the outside wires only, it being proposed to use 230 volts on each side of the neutral wire in the immediate future.

[25] I. Hamel, ''Die Entstehung der Galvanischen und Electromagnetischen Telegraphie,'' St. Petersburg. 1883.

[26] Dr. K. G. Zetzsche,''Handbuch der electrischen Telegraphie,'' Berlin, 1876.

[27] We have already shown more in detail what part the Italian Romagnosi took in this discovery.

A Plea For Better Construction Work.

BY KEPPELE HALL.

There are so many technical subjects under discussion in our electrical journals, and so much new experimental work being pursued and reported upon, that very little time or space is devoted to the actual practical side of electrical engineering. It is not the writer's intention to belittle the valuable papers that are weekly communicated to the electrical public through the press, nor in any way to detract from the importance of a careful and theoretical investigation of all subjects related to the science of electricity. The man who cries down theory, who scorns the mathematical consideration of delicate subjects, who relegates all such matters to a few experts "who have time for such things," is not a man to be relied upon. Better to have theory and no practice, than practice and no theory, for in the former case the practical part is easily acquired, while in the latter the possessor of the practical knowledge must stumble along in an unintelligent way until sooner or later he encounters a problem that he has no means at his command of solving, and he comes to grief.

But to return. It is an unfortunate fact that the average electrical installation is inexcusably poor, displaying for the most part poor workmanship, poor arrangement and poor judgment. Why is it that people will submit to have poor work done for them in the electrical line, while they are most exacting as to carpentry, masonry or plumbing? I think that this question can be answered from two standpoints. First, from the public standpoint. The average man does not know much about electrical work, and is not competent to judge whether it is done correctly or not. If he wishes electric light and has a dynamo of his own, he smiles with satisfaction when the lights burn, shakes his head with a mysterious air, remarks that "electricity is a wonderful thing and *still in its infancy*," pays his bill in haste, and repents at leisure when things begin to go wrong. Then the fact begins to dawn on his intellect that his whole installation is a mass of corruption, and when it is too late he awakes to see that there is a difference between good work and cheap work, and becomes a wiser man in the future,

The other standpoint is from the side of the contractors who do this work. As soon as electricity became generally applied as a means of light and power and the field for construction work broadened, there rushed into the business a large number of men who had perhaps been telegraph or electric light linemen, and who understood in a general way what must be done to make lights burn or bells ring or motors run, with absolutely no qualifications for contractors, and not even able to do a good, clean job in bell wiring. This sounds pretty severe, but is it not true? I am referring to the average contractor or constructor. There are, as we all know, parties who do good work, beautiful work, and who absolutely refuse to make a cheap, poor job, even if they lose patronage temporarily, to say nothing of money, by taking such a stand. These are the men who eventually succeed and who are bound to reach the top, if they only have the courage and the patience to hold out. But the average contractor flourishes and has plenty of work to do for a time, before he begins to go down hill, and in the electrical profession to-day there are a larger number of poor jobbers and a greater amount of wretched work done than in any other known branch of business.

The simple fact is that electricity, or at least electrical construction, is not in its infancy at all. It is a full-blooded youth, and the work has become an art just as much as carpentry or masonry, and there are men who can do and do do fine work in this line. Then, you ask, if this is true why need we worry, for the best men must reach the top and the inferior ones go down, and the same principles will govern this business that rule others. True; but the application of electricity is widening every day. New electric light and power companies are being incorporated, more people are availing themselves of the advantages offered, and more men are needed to do the work. A large majority of those who turn to this field are incompetent, and a large proportion of the gullible public are yet to be gulled before they learn by sad experience their error. Now, all this will take time, and in the meanwhile the reputation of the profession must suffer in consequence unless some urgent measures are taken by those who are really first-class to protect themselves. This requires the co-operation of the public and the good contractor.

When a man wants work done, and gives it out to contractors to bid on, and receives a number of proposals all in conformity to the general specifications, but varying widely in price, he almost invariably selects the lowest bidder, especially when he does not know much about it himself and cannot understand why there should be such a discrepancy in the price when all are going to do about the same work.

Let us look a little carefully into the matter and we will discover why this difference does exist. The high bidder has found out from experience and an understanding of his business that in order to have work done skillfully (wiring, for instance,) he must employ men who not only know how to tie wires, but who will be familiar with the place they have to work in, and know how to go about things in the best way. He is apt to select carpenters, and finds that they will make excellent inside wiremen. They know how a building is put together, they know where they can cut joists and stringers, and what is just as important, if not more so, they know where they *must not* cut and notch. They know how to remove and replace lath and plaster when this is necessary, without tearing down the whole wall of a house, and appreciate the necessity of having good sharp tools to work with. Each such man he pays from $2.25 up per day of nine hours. He has also found out that the cheap sockets, switches, cut-outs, wire and other materials may last for a time and give satisfaction temporarily, but that eventually they will get out of order and cause trouble. For these reasons he discards cheap labor and materials and figures on what he knows to be good and lasting.

The lowest bidder can get a laborer to work for ten hours a day for $1.25 or $1.50. He is a willing worker, a good man with a sledge, and can do wonders with dull tools, make a lot of dust and dirt and generally demolish things. Why pay more for a quiet unobtrusive carpenter? He can buy materials cheap. The sockets and switches will work, and the lights will burn when he turns them on. Why pay more for better ones even if they will last a little longer? That is what makes the difference in the estimates. In nine cases out of ten the low bidder gets the work, the lights burn, and the owner is satisfied until things begin to get out of order. Even then he is willing to pay a little now and then for repairs, and it is not until the whole installation goes to pieces, until the originally cheap job has been patched up until it will stand no further repair, but must be torn out and done over again, that he appreciates the advantage of having things done correctly at the outset, and realizes that he should have been as careful that his electrical work was done right as he was about the rest. Until this crisis comes, however, the low bidder flourishes, and the high bidder is looked upon as a fancy price man, whose work is good, to be sure, but who charges too much.

I have often wished that people could see comparative work done so that they might better appreciate what a difference there is between good and bad electrical construction. I have seen a private house wired for electric lights from cellar to garret, concealed work throughout, without disturbing or inconveniencing the family, or leaving a board out of place at night, or a speck of dirt where the men had been working. I could not but feel after it was all done and in working order, that I would like that family to have the low-priced man with his "destruction" gang do the work over, that they might draw comparisons that would be beneficial to the profession.

It certainly is distressing to see men holding positions of responsibility in connection with electrical installations who are absolutely unfitted for them. I cite the instance of a superintendent of a fire alarm system, who in his own estimation is one of the first electrical engineers in the country, but in reality a clumsy blockhead. In conversation with a member of the local electric light staff he proceeded to explain that he had a remarkably sensitive taste, and could always tell whether his batteries were in good condition or not by tasting them. He considered this a great accomplishment and one that would make him famous. It never failed. The electric light man listened in respectful silence until he had finished, when he quietly remarked: "Our lines will get across your old fire alarm wires some day, and then you'll find out what 5,000 volts will taste like. That will be a good thing to know, too." I have not heard how much progress he has made in the science of tasting batteries since then. But this is the way it goes in all the branches of electrical engineering, until eventually the uninformed will find out the truth and learn to discriminate, but in the meantime the "electrical infant" must suffer trials and tribulations enough to send it tottering to an early grave.

I have headed this article "A Plea for Better Construction Work." That what has been said or what is to follow is no news to the profession, I am well aware. The truth of it has doubtless been instilled into their minds long ago. But as little has been written on this subject, a few particulars may not be amiss before conclud-

ing, not so much for the edification of contractors as for those who are having electrical work done.

In the first place, never have concealed work done in anything but interior conduit. Contractors may insist that wiring in porcelain tubes and on cleats, under the floors and behind the plaster, is plenty good enough, and that there will be no danger of anything going wrong. This is not so. The insurance men may permit this practice, but fire is not the only thing to be guarded against. Some plumbing or carpenter work will be done some time, and a wire will be broken or grounded, and then comes the search for the trouble, with the consequent tearing up of floors and walls before the trouble can be reached and remedied. A conduit carefully installed, with all couplings made tight, so placed that it will be out of the way, or, better still, made of iron, when it is indestructible, continuous from cutout to outlet and from outlet to outlet, leaves little or nothing to be desired. It is a simple matter to pull out a wire and shove a new one in, but it is a pretty serious matter to replace one when no such provision has been made.

The indiscriminate scattering of cutouts or fuse-blocks is to be condemned. If possible it is advisable to have every fuse in one place where it can be easily replaced without searching all over for the right cutout. This costs more money, for it requires more tube and wire, but when the convenience is taken into consideration it will be found to more than pay. Of course where a building is very large, such a plan is not feasible, but, in this case, distribution centres for each floor can be selected and all the cutouts gathered there. Then every fuse should have stamped copper terminals, showing the carrying capacity, and when a fuse blows one knows what to replace it with. Great care should be taken not to have any one set of lights on one fuse, but all should be arranged so that when one circuit is disabled, no place will be left in total darkness. Then there are the miserable switches that are so flimsy that they melt up when half loaded, or are so poorly adjusted that they can't be depended upon for half a day at a time. The same of sockets and other materials may be said. This is what makes the cost of house wiring vary so in amount, and it is not simply necessary to look at a man's bid before giving him the work, but to examine into his materials and see what he is going to use and how he is going to use them.

A contractor can generally be sized up from the way in which he performs small jobs. Every man in the construction business is called upon, from time to time, to do small pieces of work, not amounting to much in cost or profit, but work that must be cheerfully done and well done, in the hope of some time securing larger work from the same party. Let us take, for example, ordinary bell wiring, for call bells or annunciator. Bell wires should never be run in plaster as is generally done, and two wires should never be fastened under one staple. Installations put in in this miserable manner may give satisfaction for a long time, but when once trouble does occur, it is next to impossible to remedy it. Bell wires, where they run behind plaster, should always be run in tubing, and the man who takes this precaution and uses bells that can be relied on not to get out of adjustment for years, push buttons that will continue to work satisfactorily after long usage, and good reliable batteries, is the man to be trusted with large contracts, with the assurance that the work will be done with the same painstaking care that has characterized his other work.

In conclusion a few words to the contractor. Never be persuaded to do inferior work in order to secure a contract. This principle rigidly adhered to will eventually lead to success. The waiting will be hard and it will often seem as if the policy didn't pay, but it will in the end without any doubt, only stick to it. In conversation with a prominent hardware dealer and plumber a short time ago, talk turned to the subject of doing first-class work with first-class materials. He told me that when he began to handle heaters for residences he had a long line of them standing in his store, ranging in price from $100 to $25. A customer would be shown the high-priced heater first, go down the line and probably buy the cheap one. A man can't condemn his own stock, so the dealer couldn't say that the cheap heater was no good, for then the inevitable question would be asked "Then why do you sell it?" Winter would come and then the trouble would begin. Not enough heat, not a good enough furnace to be capable of giving enough heat. Friends visiting the house on a cold day would hear the tale of woe, the dealer's name would be mentioned, and down would go another black mark opposite his name and reputation. This continued for some time, until finally he adopted one first-class, high-priced heater, and threw all the rest out. He now has no trouble, no complaints and but little competition. People know that he does good work and can be relied on. The extra amount paid will not be wasted. This is true in the electrical business. There is plenty of room at the top for those who will do exclusively good work, and prove by their actions and business methods that they have a right to that position.

Another experience may further serve to illustrate our moral. Some electric ceiling fans were sold to the proprietor of a restaurant. The buyer sent the measurement of the ceiling and the fans were ordered. The wiring was done, and when the fans arrived they were two feet too short. The customer had given the wrong height of ceiling. It was his fault, he was in a hurry, so the fans were pieced out with iron pipe and put up. It was not a neat job, but he was perfectly satisfied, and paid his bill. A few days after another man came in, looked at the fans and inquired who did the work. On being told he walked out, went to another dealer, and gave him an order for fans at a higher price than had been quoted him previously by the man who put the fans in the restaurant. It didn't pay to leave those fans looking like that for a day, and it never does pay to do slovenly work, no matter who is satisfied.

The few particulars enumerated above might be extended indefinitely to every branch of work, for what is true in one is true in all. These should suffice to illustrate the point, and individuals can apply what has been said of house wiring to the equipment of electric roads, light and power stations and work of greater magnitude.

If, on the one hand, owners would insist on having better work done, and if contractors, on the other, would refuse to do cheap work, both would combine in assisting to put electrical construction work on a higher basis and hasten the time when true merit would be appreciated and rewarded. This standard has already been established for other branches of labor and it is high time that it should be brought about in ours. The writer had occasion to call attention to the fact that architects should be careful to have their specifications accurately drawn and the electrical work under their jurisdiction skillfully superintended, in an article published in this journal some months ago. The perfection that has been attained in the manufacture of machines, instruments and materials for electrical purposes should call for a higher grade of workmanship in their installation.

The public must be educated, and it is far better for them and for the trade that their knowledge be acquired by finding out that good work can be done, than learning that it is a rarity to find good workmanship in electrical construction.

An Electrolytic Process for the Manufacture of White Lead.*

BY R. P. WILLIAMS.

The new process is a radical departure from all the old ones in not employing acetic acid at all, but in acting upon lead with nitric acid which is generated by electricity. The process consists of four reactions as given on the chart. First, the electrical preparation of nitric acid and sodium hydroxid. Second, the action of nitric acid on lead, forming lead nitrate. Third, the reaction of lead nitrate and sodium hydroxid to form lead hydroxid. Fourth, the combination of lead hydroxid and sodium bicarbonate to form lead carbonate.

In the first step of the process a solution of nitrate of sodium, $NaNO_3$, is decomposed by an electric current from a dynamo. The strength of solution required is not important, 10 "Baumé," or, say, one pound to the gallon, being sufficient. This solution is put into a series of cells, constructed of wood, and divided into two compartments by a porous partition. At the plus electrode is fastened a pig of lead, and at the minus a sheet of copper. The solution being run in from an overhead reservoir and the current turned on, the nitrate is decomposed, according to equation (1), nitric acid collecting at the plus electrode and sodium hydroxid at the minus. The nitric acid at once attacks the lead and forms lead nitrate, which dissolves equation (2); whereas, the hydrate of sodium produces no effect on the copper at the negative pole. Finally the nitrate of lead solution and the hydrate of sodium solution are drawn off separately and mixed as desired, in quantitative proportions, in a receptacle. The result, as shown in equation (3), gives lead hydroxid as a white, amorphous precipitate, and leaves nitrate of sodium in solution. This is practically the original nitrate and its regeneration shows one of the economic excellencies of theprocess, for the nitrate can be used over and over again, as the source of more acid. It has been found at the experiment station that but little additional sodium nitrate is required for a repetition of the process complete as the original. The lead hydroxid is then filtered from the sodium nitrate. This is done automatically and continuously, by a rotary

* Read before the American Chemical Society.

filtering device, and the nitrate of sodium is pumped back into the original reservoir.

The fourth step is in some respects the most interesting of all, and consists in adding to the lead hydroxid a solution of bicarbonate of sodium (or of the normal carbonate). Reaction (4)at once takes place. It will be noted that sodium hydroxid is the product in solution, and lead carbonate the precipitate.

Here is another beauty of this process. Sodium hydroxid removes most of the impurities, if there are any, in the hydrate of lead. For instance it will dissolve any salts of Al or of Zn, and it removes organic matter.

These impurities appear in the solution, leaving the precipitate remarkably white. Once more, this lye product, hydroxid of sodium, is converted into bicarbonate by passing $C O_2$ into it, and this can be used again. Thus the main agents in each of the two principal steps, nitrate of sodium and bicarbonate of sodium, are made to do duty over and over again with but slight additions.

(1) $Na NO_3 + H_2O = Na OH + H + NO_3$.
(2) $2H NO_3 + Pb = Pb (NO_3)_2 + H_2$.
(3) $Pb (NO_3)_2 + 2Na OH = Pb (OH)_2 + 2Na NO_3$.
(4) $Pb (OH)_2 + HNa CO_3 + Na OH + H_2O$.

It is doubtful whether (1) and (2) take place as there given. It is better to combine them as below, since H is liberated at the minus electrode:

$2Na NO_3 + 2H_2O + Pb = (2NaOH + H_2) + PbO (NO_3)_2$.

Let us now turn from the theoretical to the practical part of the matter. The first question which naturally arises is: Will this process, so beautiful in theory and as a laboratory experiment, work on a large scale and give sufficiently practical results to compete with the other methods of manufacture and make it a lasting contribution to inventive science?

An experimental station was for several months in operation in Cambridge, Mass., erected and run under the direction of Mr. Arthur Benjamin Brown, the inventor of the process. This was capable of turning out some 500 pounds of white lead per day. Its success was regarded as beyond dispute. The cost of white lead by this process need not detain us long. Suffice it to say that it is but a fraction of the cost by the Dutch method.

First, in the electrolytic process pig lead is used as it comes from the smelting furnace. In the Dutch method it has to be remelted, cast into "buckles" of definite size, and, after the action of acetic acid, from one third to one half is left uncorroded, and has to be recast.

Second, the process is almost instantaneous, as every reaction takes place rapidly, while by the other mode from two to six months is required. Third, in materials and labor there is great saving. No free acid is used, either acetic or nitric, and the agents, nitrate and bicarbonate of sodium, are used repeatedly. By the old method, a plant covering a large area is filled for months with fermenting tanbark or manure, acetic acid and lead, while the process is going on, and at its completion the product is removed with much labor, and has to be thoroughly and repeatedly washed to dissolve out any acetate of lead remaining. It must be ground and reground under water and even then is likely not to be of uniform texture. It is also a poisonous and dirty process. The electric method is complete the same day and hour, for that matter; it being continuous, requires but a very small force of men, as almost all the operations are automatic, and is a clean and non-poisonous process.

The texture of the product is almost molecular in fineness, as it must be from its being produced by replacement in the hydroxid. Hence, it needs no grinding. It is so fine as to remain suspended in water for a long time, and in order to filter it a special brand of cloth has to be made, as even filter paper would scarcely retain it.

One of the most practical questions is: How does paint made from electrolytic white lead compare with that made from Dutch lead in durability, opacity and covering power? Specimens have been submitted to some of the largest dealers and painters in New England and elsewhere, and Mr. Brown, the inventor, has spent the last two years, aided by a competent corps of assistants, not only in the development of his new process, but in making thorough and systematic tests of the product. Inside and outside surfaces have been exposed to the severest extremes of weather, to the varied fumes of the laboratory and to other crucial tests. Dutch paint and electrolytic paint have been exposed side by side for two years, and no difference can be detected in durability or opacity. The covering power of the new paint is considerably greater than that of the Dutch. Experiments vary as to the increased percentage from 12 to 20 or even higher, but in no case was there found to be a *smaller* percentage.

What is the cause of such an increase? This leads us to discuss somewhat more fully the nature and composition of white lead made by the various processes. Dutch white lead consists approximately of two molecules of the carbonate to one of the hydrate, $2Pb CO_3 Pb (OH)_2$. This, however, appears not to be constant, as might be inferred from its mode of manufacture. Lead hydrate, or the hydrate oxid, is a white amorphous substance. Lead carbonate $Pb CO_3$ is either a spongy transparent, globular powder, or is crystalline—whether globular or crystalline depends upon its mode of preparation. Now certain properties of these two forms are quite different, and this difference explains the use of one and the disuse of the other form as a pigment. The globules of the ore form are said to be from $\frac{1}{100000}$ to $\frac{4}{100000}$ of an inch in diameter. These, in the grinding of the lead with linseed oil, are supposed to take up the oil somewhat as a sponge absorbs water. The Dutch process lead is the globular variety, and to this fact has been attributed the greater body and permanence of the paint made from it than that made by most other processes. The crystalline variety of the carbonate is found not to absorb oil to anything like the same extent as the globular, no matter to what degree of fineness it is ground, the surface of the minute crystals being impervious. Half a century ago the "quick" or "French lead process" was invented and is now carried on in Clichy, France, and some other places, being sold as "Clichy White." It is made by dissolving litharge, PbO, in acetic acid, and then passing into the sub-acetate of lead solution formed of carbonic acid gas. Thus is formed neutral carbonate of lead. It was at first thought to be a revolutionary process, but it soon appeared that it did not give the opacity or "body" which Dutch had given, and of course it lacked permanence. Made in this way the carbonate is crystalline. Under the brush it is found not to cover as much surface and not to spread as well, or it is said to lack "body," although of the same composition as the other.

Other rapid processes—and there have been hosts of them—have invariably met with no better success for the reason that the carbonate formed is the crystalline instead of the globular variety, and to this fact we may mainly attribute the long-continued use of Dutch process lead.

The committee of experts appointed by the British home secretary visited 46 works and found only one using the precipitation process, and there the chamber process. They say: "While some of the substitutes are cheaper to make and far less poisonous, yet they are far from equaling the Dutch as a pigment. Neither can they recommend other processes than the old Dutch process for manufacturing the product."

Thus we see that until now no cheaper method has been found for producing the globular variety. The electrolytic process does produce the globular kind, and a finer variety even than the Dutch, so fine in fact that it was almost impossible to find a filter that would retain it.

This probably accounts for the superiority of the electrolytic brand, as regards body and covering power, over any other kind produced. Experiment shows that the pure carbonate will do as well as a mixture of carbonate and hydrate. By the new process it is perfectly simple to make either the pure carbonate or a mixture in any proportion of carbonate and hydrate.

No other white pigment has yet been found, or seems likely to be found, which will take the place of white lead. The two main substitutes are zinc white ZnO, permanent white $Ba SO_4$. But these do not stand the test with lead white, leaving far less opacity and less covering power. Especially will they not with the cheapening of the latter by the new process. Hence we must look to lead to give us the white pigment of the future.

There are but three common solvents of this metal. These are chlorin, acetic acid, nitric acid. Chlorin is at once ruled out for all practical purposes for reasons that need not be mentioned here. Acetic acid seems to have been the substance universally employed to the present time for getting the metal into a preliminary state for making the carbonate. As before noted, Theophrastus (300 B.C.) made white paint by using lead and vinegar, and a number of authors mention the process from Pliny down.

Inasmuch as acetate of lead is a complex substance, it breaks up readily under the influence of electricity, and gives intolerable fumes. Hence nitric acid must be used. But free nitric acid is objectionable for the same and other reasons; thus compelling recourse to sodium or potassium nitrate.

The new process was invented in 1892 by Arthur G. Brown.

Electrodynamic Machinery—XLVII.

BY EDWIN J. HOUSTON AND A. E. KENNELLY.

350. If it becomes necessary, as we have shown, to insert resistance into the circuit of a shunt-wound motor armature, in order to start it from rest, it is still more necessary to insert resistance into the armature circuit, in order suddenly to reverse its direction of motion. When the armature terminals of a shunt-wound motor are suddenly reversed relatively to the mains while the field magnet coils remain permanently excited, the E. M. F. of the armature due to its speed, which was before the reversal a C. E. M. F., tending to check the passage of current strength through its coils, becomes a driving E. M. F., tending to increase the current strength passing through it from the mains. The effect of a sudden reversal in a shunt-wound motor armature is, therefore, practically equivalent to suddenly throwing the armature across a pair of mains having double the pressure of those actually employed, and with the attending consequences of an enormous overload of current strength, which first checks and then reverses the direction of armature rotation.

351. Various devices are employed for preventing a motor armature from being injured by the sudden reversal of its terminals with the mains. At the time when armatures were almost all smooth cored, damage was frequently done by shearing the wires off the armature core under the very heavy electromagnetic stresses thus brought to bear upon the wires. When toothed-cored armatures became generally used this danger practically disappeared, but the danger of damaging either the insulation of the wires or the mechanical framework of the armature, or of burning out some of the conductors, still remains. A *starting coil* is frequently employed with street-car motors which consists of a coil of strip-iron conductor, having a hollow interior, so that it contains a large magnetic flux when excited. The C. E. M. F. suddenly developed from such a coil, on being magnetized is sufficiently great to check, for the moment, the first inertia of current, and such a coil may be called an inductance coil.

352. Fig. 216 represents the diagrammatic connections of a particular form of automatic switch and starting rheostat sometimes employed with large motors. The larger the motor the more expensive does any accident become which may happen to its armature, and the more economical it becomes to take precautions against such accidents. Referring to the figure, it will be seen that the mains or line wires are connected directly to two circular contact segments *SS*, through the coils of a relay magnet *M*. When the handle *H* is in such a position that the two contact bars *BB* rest in the intermediate position, they lie out of contact with the segments, and the current is then entirely cut off the motor. A powerful spring wound about the axis on which the handle *H* moves, tends to bring the handle and the bars *BB* back to this zero or "off" position. If the handle is pressed forward in the clockwise direction against the pressure of its spring, the line wires are connected with the armature through the resistance coils *r*, *r*, *r*, which are wound upon spools of insulating and non-inflammable material within the box and also through the field coils of the motor. When the handle is pushed completely around to the "on" position, the extra resistances are cut out of the armature circuit and the armature thus becomes enabled to run at full speed. In this position the handle is prevented from returning to zero and is kept in place by the detent magnet *D*, excited by the current passing through the field coils. If the circuit of the field coils should accidentally become broken, the magnet *D* will release its armature, which will release the detent, which will allow the handle *H*, with its contact bars *BB*, to return to the "off" position under the action of the spiral spring; or, should the armature current become excessively strong, thereby endangering the armature, the relay magnet will attract its armature, which will thereby short-circuit the detent magnet, and the same result will follow. The armature will, therefore, be stopped by any overload and will be cut out of circuit by any accidental cessation of the current in the field. By means of a push-button circuit the armature can be brought to rest by pressing a push button placed at any distance from the machine.

353. All the phenomena of armature reaction which we have traced in connection with dynamos in Secs. 176 to 200 are presented by motors, with the exception that the direction of the M. M. F. of the armature relatively to the field magnets is reversed, that is to say, a motor runs so that the magnetic flux produced by its armature tends to pass through the pole which the armature approaches; *i. e.*, the leading pole instead of the trailing pole, or that from which it is forced in the dynamo. With this exception all the effects of sparking and demagnetization present themselves equally in motors as in dynamos. The diameter of commutation in a generator has to be advanced in order to obtain a sparkless position; in other words, a lead has to be given to the brushes, while in a motor the diameter of commutation has to be retrograded to arrive at the same result; in other words, a lag has to be given to the brushes.

354. In order to reverse the direction of rotation of a motor a single rule has to be borne in mind; namely, the M. M. F. either of the field or of the armature must be reversed. If the M. M. F. of both field and armature be simultaneously reversed, the direction of rotation of the motors remains unaltered.

355. Fig. 217 is a complete diagram showing the relations which exist between the direction of rotation and the direction of current in the field and armature of different machines. The horizontal row on the top represents separately-excited machines, the next lower row shunt-wound machines, and the lowest horizontal row, series-wound machines. The first vertical column, No. I, on the right, represents generators. Column II, next in order to the left, represents the action of these machines as motors, when mounted in connection with the mains but not supplied with sufficient driving power to maintain the machines as generators. Column III represents the effect of reversing the connections of the armature when the machine is acting as a motor. Column IV represents the effect of reversing the field connections instead of the connections of the armature. Column V represents the effect of reversing both field and armature connections, which is equivalent to reversing the entire machine relatively to the mains. The large arrow on the field coil represents the direction of the M. M. F., or of flux through the field. The large arrow in the armature represents the direction of the M. M. F. in the armature, due to the current. The small arrow in the centre of the armature represents the direction of the armature E. M. F., relatively to the circuit, and the curved arrow outside the armature represents the direction of rotation of the armature.

356. Referring to the line or row of separately-excited machines, in Column I, the machine appears as a generator, rotated by the driving belt in the direction of the curved arrow. The E. M. F. of the armature is in the direction of the current through the armature, and the mains are supplied with current from the brushes, as shown. If the driving belt be suddenly thrown off the armature pulley, the machine will run for a few moments by its inertia, still supplying current to the mains, until the power so expended has absorbed the surplus energy of motion of the armature, when the speed and E. M. F. of the armature will diminish, until the E. M. F. is exactly equal to that between the mains, which are assumed to be maintained at constant difference of potential by another source of supply. At this moment there will be no current through the armature. If there were no friction in the armature, this condition might be retained indefinitely, but since every machine must expend energy against frictions, the speed of the armature continues to slacken and the E. M. F. in the armature falls below that in the mains. Current will then pass back from the mains through the armature, as shown in Column II, reversing the M. M. F. of the armature, but maintaining the same direction of rotation. The machine is now rotated as a motor, absorbing energy from the mains, and the E. M. F. of the armature is now a C. E. M. F., as shown by the position between the direction of the small arrow in the centre of the armature and the arrows representing the direction of current through the armature. Consequently a separately-excited machine runs in the same direction as generator or motor, if no change is made in the armature or field connections. If the armature connections be reversed, as represented in Column III, or if the field connections be reversed, as represented in Column IV, the direction of rotation of the armature is reversed, but if both field and armature connections be reversed, as in Column V, the original direction of rotation is retained.

357. In the shunt-wound machines, represented in the second row, practically the same conditions are observed to follow, namely, if the driving belt be thrown off the pulley of the machine acting as a generator, when connected to constant-potential mains, current will pass through the armature in the opposite direction to that which passes when the machine is a generator, thus reversing the M. M. F. of the armature, but maintaining the direction of rotation. Reversing either the field or the armature reverses the direction of rotation, but reversing the entire machine; *i. e.*, both field and armature, has no effect upon the direction of rotation.

358. The third row of series-wound machines differs, however, essentially from the foregoing. It will be observed that if the belt be thrown off the generator, as soon as the E. M. F. of the armature is brought down to that existing between the mains, no current passes through the mains and the field magnets lose their excitation. It will follow from this that the E. M. F. of the armature will very rapidly disappear, and a large rush of current will pass through the armature from the mains, reversing the direction, not only of the armature M. M. F., but also of the field M. M. F., so that the machine is first brought to a standstill, and then rotated in the opposite direction. It is clear, therefore, from this consideration, why series-wound machines are never employed as independent units in parallel for supplying a system of mains; for, if by any accident the engine driving a series-wound generator failed to maintain the E. M. F. of its armature above that of the mains, the machine would become a short circuit upon the mains, and an enormous rush of current with a correspondingly violent mechanical effort would be brought to bear upon the machine, tending to reverse its motion and drive the engine backward.

359. If the series-wound machine be considered as running in the direction represented in Column II, and the armature connections are then reversed, or the field magnet connections reversed, as in Columns III and IV, the direction of rotation of the armature will be reversed, or restored to the direction of rotation as a generator; while, if both field and armature be reversed, as shown in Column V, the direction of rotation will be the same as in Column II.

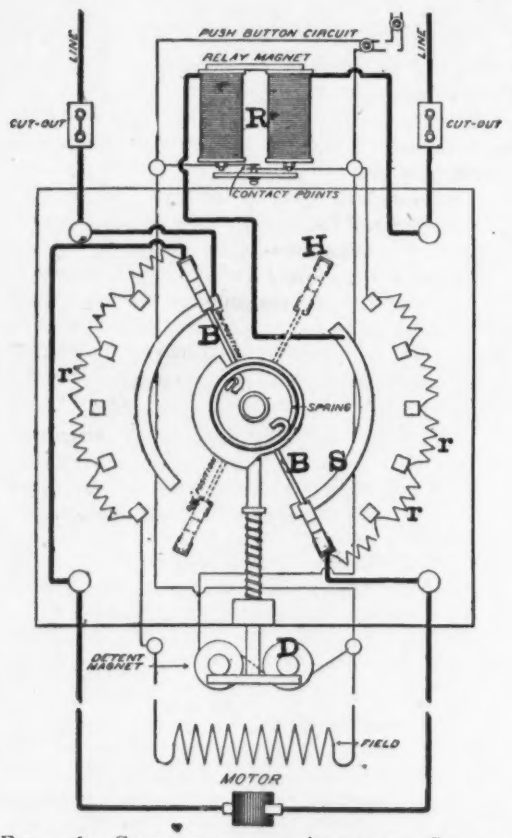


Fig. 216.—Connections for Automatic Safety Switch and Starting Rheostat.

360. It is evident, therefore, from an inspection of the diagram, that it is only necessary to reverse the direction either of the M. M. F. in the armature or in the field, to reverse the direction of rotation of the motor, and that the relative direction of the M. M. F. in field and armature is opposite in a motor to what it is in the same machine as a generator. For this reason the leading pole-pieces of a machine when operating as a generator are the following pole-pieces when operating as a motor and *vice versa*.

361. In practice, it is always the connections of the armature of a machine which are reversed in order, suddenly to reverse the direction of its rotation, for the reason that the inductance of the armature being usually much less than that of the field, the change is more completely effected and with less danger of injuring the machine by an overload of current. On the other hand, if the machine be brought to rest and disconnected from the circuit, it may be just as convenient to reverse the field-magnet connections as the armature connections, in order to effect a reversal of rotary direction when the machine is next started.

362. In all cases it has to be remembered that it is dangerous to break the circuit of the field magnets of a motor when in operation, not only because by so doing the M. M. F. of the field is almost entirely removed and thereby the armature is unable to develop a C. E. M. F. and becomes practically a short circuit on the mains, but also because the powerful E. M. F. generated in the field coils by self-induction, when their circuit is interrupted, may find a discharge through the armature insulation in such a manner as to pierce the same and permanently injure the armature. The same remarks apply to the operation of machines as generators. The field magnet connections should always be the first to be completed and the last to be interrupted when the machine is operated in either capacity.

363. In some cases, it is possible for the M. M. F. of the armature to overcome that of the field magnets, and actually to reverse the direction of magnetic flux through the magnetic circuit of the machine. For example, if a shunt-wound machine be operating alone and supplying a system of mains, it is possible for a very powerful current passing through the armature to produce such an armature reaction as shall effect a large C. M. M. F. in the magnetic circuit of the machine, and so reverse the magnetic flux in the circuit. As soon as this is effected, the E. M. F. of the armature will be extinguished and the machine will cease to send a current. This effect is distinct from the tendency of shunt-wound generators to lower their E. M. F. under heavy loads by reason of the drop in the armature and its effect upon the excitation of the field magnets. It can only happen when the brushes of the machine are given a considerable lead, for, if the brushes be maintained at the neutral point midway between the poles, it will be impossible for the armature reaction to produce a dangerously large C. M. M. F. in the main magnetic circuit. Such accidents have, however, taken place in central stations with types of generator in which the armature reaction and lead of the brushes at full load is considerable, and for this reason it is preferable to excite the field magnets of large central station generators from independent machines, when possible.

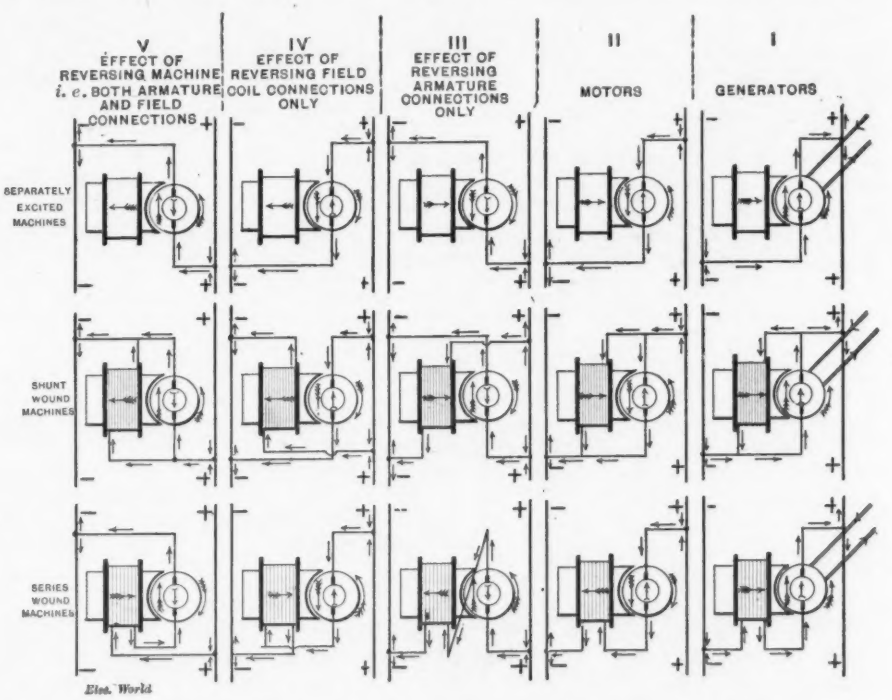


Fig 217.—Diagram Indicating Directions of Rotation of Motors.

364. In motors, which are required to have their direction reversed, it is necessary that the brushes shall rest upon the commutator in such a position as shall permit of this reversal of direction without danger. Carbon brushes are employed with practically all 500-volt generators and motors, and with such machines for lower pressures as will permit of the passage of the full-load current through the carbon brushes without dangerously overheating them. Their advantage is that they wear evenly, lubricate the surface of the commutator, and are readily replaced. Their only disadvantage is their high resistivity, and the noise they are apt to make if the commutator surface is not perfectly uniform.

(To be continued.)

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DIGEST OF CURRENT TECHNICAL ELECTRICAL LITERATURE

BY CARL HERING

COMPILED FROM THE PRINCIPAL FOREIGN AND AMERICAN JOURNALS

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DYNAMOS, MOTORS AND TRANSFORMERS.

Armature and Magnet Coils.—In an article by Mr. Hill, begun in the Lond. "Elec. Rev.," Aug. 23, he intends to give some convenient formulas for facilitating the calculations relating to dynamos. In the present portion he discusses armature temperature and sparkless collection. For ordinary armatures running at the usual peripheral velocity of 3,000 feet per minute there is a rise of temperature of 1° C. for every 0.03 watt per square inch of surface; the watts per square inch will be greater in ring armatures at the ends and in the hole, and in drum armatures at the ends than on the periphery. In designing armatures it is customary to base the size of the wire on some arbitrarily chosen current density, the rise of temperature being then calculated and if not correct, the proportions are re-designed; to avoid this process of trial calculations he develops a formula giving the size of the wire directly from the rise of temperature, basing it on the surface of one conductor one inch long; the formula is somewhat complicated and involves an assumption of the ratio of the width of conductor to the total width of space occupied, which ratio he gives as 1.35. He discourages the practice of allowing a certain current density in specifications for dynamos; as far as temperature is concerned, in a dynamo of which the dimensions are not known, current density has nothing to do with the case. Regarding sparkless collection he states that the gap should be so proportioned that the magnetic potential required to give the correct flux for the voltage and speed equals that necessary to balance the armature cross-turns, added to that required to give a reversing field of sufficient strength to effect a sparkless collection; if it is less than this sum, there will be sparking, while if it is greater there is a useless waste of energy; no figures are given relating to the correct value of the magnetic potential required to give a reversing field of sufficient strength to effect sparkless collection; in ring armatures and wrought-iron magnets of his own dynamos he found by experiment that the ampere-turns required to give the proper value is 11.25 times the ampere-turns per coil on the armature irrespective of the size of the machine; in a number of drum armatures of various sizes and makes he finds that this figure varies from 26.5 to 29.6.

Some General Properties of Rotary Magnet Fields.—A long article by Prof. Blondel, forming the first part of an article on this subject, is published in "L'Eclairage Elec.," Aug. 10; he limits himself to fields in multipolar motors; in the present portion the results are not given in a form to admit of being abstracted.

LIGHTS AND LIGHTING.

Etching Incandescent Lamp Bulbs.—"L'Energie Elec.," Aug. 16, gives the following formula taken from a German journal, for indelibly marking incandescent lamps; in addition it recommends very highly the practice of central stations numbering each lamp as it is sent out from the station. Dissolve 36 gr. of sodium fluoride and 7 gr. of sulphate of potash in 500 gr. of water; prepare another solution of 14 gr. of chloride of zinc in 500 gr. of water adding 65 gr. of hydrochloric acid; when it is desired to mark the lamps, mix together equal parts of these two solutions and use it as though it were ink.

Fusing Metal on Glass in Incandescent Lamps.—"L'Energie Elec.," Aug. 16, gives the following formula: make an alloy of 25 parts of zinc and five parts of copper, which can be made hard or soft by the addition of 0.5 to 1.0 per cent. of lead or zinc respectively; this alloy has the same coefficient of expansion as glass and is said to be perfectly adapted for incandescent lamps.

Unsolved Problems in the Manufacture of Light.—The "Pop. Sc. Mo." for September abstracts briefly from a recent lecture by Prof. Cox, with this title, read before the Royal Society of Canada. After a discussion of the poor efficiencies in the production of electric light from coal, showing that only three parts in a thousand of the original energy of coal ultimately becomes useful as light, he states that "in the last six years, however, some hints of means to overcome the difficulty have been obtained from the proof by Maxwell and Hertz that light is only an electric radiation. Could we produce electric oscillations of a sufficient rapidity, we might discard the molecules of matter and directly manufacture light without their intervention. To do this we must be able to produce oscillations at the rate of 400,000,000,000 per second. Tesla has produced them in thousands and millions per second, and Crookes has shown how by means of high vacua to raise many bodies to brilliant fluorescence at a small expense of energy. . . . These are hints toward a solution of the problem, but give no solution as yet. Prof. Langley states that the Cuban firefly spends the whole of its energy upon the visual rays without wasting any upon heat, and is some 400 times more efficient as a light producer than the electric arc, and even ten times more efficient than the sun in this respect. Thus, while at present we have no solution of these important problems, we have reason to hope that in the not distant future one may be obtained, and the human inventor may not be put to shame by his humble insect rival."

Profit in Arc Lighting.—Under this heading Prof. Thomas in the "Elec. Jour." (Chicago), Sept. 1, calls attention to the complaint that there is no profit in many plants, and suggests that a substantial decrease in expense may in many cases be effected by discarding the old steam engines and replacing them with the improved forms of to-day. Six to nine pounds of coal per lamp per hour is commonly reported, while recent data shows that three pounds is abundant.

POWER AND HEAT.

Worm Gearing in Connection with Electric Motors.—The "Elek. Zeit.," Aug. 15, contains an illustrated article by Mr. Kolben, a translation in abstract of which is given in the Lond. "Elec. Rev.," Aug. 23, without the illustrations. Mr. Egger in a previous article stated that when worm gearing is used it is particularly advantageous to use slow-speed motors. Mr. Kolbens in the present article contradicts this, stating that from experience he finds that high-speed motors should be used exclusively if the work is to be commercially practicable and the efficiency good. After referring to the work done in this direction by others, he gives his experience with the ordinary double-thread worm gear used by the Oerlikon Company. The worm was 80 mm in diameter, had a multiple-ring bearing; the bronze wheel had 28 teeth and was 373 mm in diameter, the whole gear being placed in a cast-iron box containing oil; it was coupled to a 20-hp motor, and braking tests were made; at 1,500 revolutions 21 useful horse-power was realized at an efficiency of 87 per cent.; he believes that the efficiency with the motor fully loaded will increase even beyond 90 per cent. if the following points are considered in the construction: the starting speed should, according to the output, amount to 6 to 12 metres per second instead of 0.5 to 2 m, as is customary; this necessitates the use of high-motor speeds and a large diameter of worm, and consequently great distances between the teeth, powerful teeth and ample bearing surface; this will reduce the friction; when applied to elevators the whole speed reduction can be obtained without any intermittent gear, with single or double thread worms, having a ratio of reduction of 10 to 1 or 20 to 1; the mechanical construction requires the greatest care; the worm must be turned out of a solid piece of tool steel and be tempered, smoothed and polished; the crown of the teeth should be made of hard phosphor-bronze and if of large diameter it should be drawn hot on to a cast-iron arm crown; the teeth are to be properly cut and polished; the friction coefficient between steel and bronze will be reduced by the bath of oil from 0.01 to 0.005; gear constructed in this manner operates noiselessly, has only a slight wear and a life of several years; in order to reduce to a minimum the friction of the whole mechanism on the starting of motors at full load, the pressure is taken up by starting discs arranged on both ends of the worm; curves of the results of the tests are given, as also illustrations of the application of the worm gearing to a number of the different machines.

Calculation of Alternating-Current Power Transmission.—A series of articles of a mathematical nature, by Dr. Behn-Eschenburg is begun in the "Elek. Zeit.," Aug. 22. He intends to deduce practical formula for calculating the proportions in alternating-current installations or the efficiency of existing plants; he intends to consider the chief dimensions and properties of alternators for single and multiphase currents, synchronous and non-synchronous motors, transformers and the line; he will also describe tests by means of which the important relations can best be determined. In the present portion he considers generators and describes a test for determining the properties. The article does not admit of being abstracted.

Rock Drills.—The "Elek. Zeit.," Aug. 22, contains the first part of a long article describing, with the aid of a few illustrations, the electrical rock drills made by Siemens & Halske both of the percussion and the

rotary types; it is claimed that this apparatus has been so perfected that it can be connected to any convenient system of electric mains such as is in use for lighting and power purposes; the application of the flexible shaft is also described.

Dust Destructor.—Those used at the St. Pancras station, where 18 cells are to be installed, are described and illustrated in the Lond. "Elec. Rev.," Aug. 23.

Electric Furnaces.—The Lond. "Elec.," Aug. 23, publishes a translation of the complete paper of Mr. Street, which was abstracted in the Digest, July 27, including all of the numerous illustrations and the list of patents.

Electric Motors in City Water Supply.—A plan devised by Prof. Barrett and suggested to be used for improving the water supply of Chicago, is described and illustrated in the "Elec. Jour." (Chicago), Sept. 1. It is proposed to erect a number of local sub-pumping stations at various points in the city, operated by electric motors, which raise the water from the mains into local towers for further distribution under practically a new pressure. It is thought that the cost in that city will be about a half million dollars, as against ten times the amount which the water department estimates it will cost to make the service competent to meet the conditions. The regulating device, operated by a float in the tower, is illustrated.

Heating Railway Cars.—A correspondent to the "St. Ry. Jour.," in the issue for September, suggests a number of points regarding stove heating which should be considered in comparing the electric heater with the coal stove, and which, if taken into account, will go far toward balancing the difference in the cost of the coal and the current. Among these may be mentioned the cost of installing the stove, complete, removing it in summer, the space occupied, want of uniformity of temperature, danger of fire, kindling of fires, smoke in car house, etc.

Gold Dredging.—The paper by Mr. Hay, mentioned in the Digest, March 30 and May 25, is reprinted in "El'ty," Sept. 4.

TRACTION.

Snaefell Mountain Railway.—A brief description of this electric mountain road, which is about to be opened, is given in the Lond. "Elec. Eng." and Lond. "Elec.," Aug. 23. Snaefell is the highest peak on the Isle of Man, its summit being 2,000 ft. above the sea; the average gradient of the line is 1 in 12; in place of a rack railway, a system devised by Mr. Fell was preferred and in this there was a central rail between the bearing rails, and raised somewhat above their level; the bogies contain runners which clutch this wire horizontally; there is also a gripper brake which is used to aid the ordinary brakes. The generating station contains five shunt-wound dynamos of 55 kw, each driven by a special engine; the voltage is 550; the plant is sufficient for running four or more cars each with 48 passengers simultaneously up the line with a speed of 8 to 8.5 miles per hour; in addition to the dynamo station there is an accumulator station along the line which is equipped with a battery of 240 "chloride" accumulators; the overhead conductor system is used; each car contains four motors, one on each axle; they operate with a single reduction gear.

Jungfrau Mountain Road.—The "Elek. Zeit.," Aug. 22, contains a note on the recent progress in this plant. A prize of $4,000 is offered for the best project for the electrical system, the road construction, the track and the rolling stock. The following information is given: The water power amounts to 7 to 8,000 hp; the speed is to be about 7 km per hour on a grade of 15 per cent. and 7 km for over 15 per cent. grades; the maximum grade is not greater than 25 per cent.; the gauge is 1 meter, the minimum radius 100 m, the width of tunnels 3.2 m; the cars are to be closed and the trolley line will be overhead.

Double Trolley in Japan.—The "Elec. Friend" (Japan) for July states that a new trolley company has been formed in Tokio with a capital of $1,900,000 to construct 85 miles of double-trolley roads in that city; it appears that the double trolley is also to be used in Yokohama. The company is compelled to use the double trolley as the single trolley is objected to by the municipal authorities. The same issue contains a report of an investigation of electric street railway systems; a special committee was appointed to consider the objections to the single trolley with special reference to the danger to existing water pipes and single telephone circuits, the committee consisting of Prof. Yamakawa and Mr. Asano, the electrician for the department on communications; they discuss the matter from a practical and a theoretical standpoint, taking into consideration the opinions of American and European authorities.

Conduit System.—A well-illustrated description of the Hoerde system which was described in the Digest, March 30 and June 8, is published in Lond. "Engineering," Aug. 23.

Railway and Lighting Installation in Baden.—The "Elek. Zeit.," Aug. 22, contains a well-illustrated article by Mr. Buehring describing the installation in Baden, near Vienna.

Self-propelled Vehicles.—A translation of the article by Mr. Hospitalier, which was abstracted in the Digest, July 20, is published in the Lond. "Elec. Rev.," Aug. 23.

Electric Car Tests.—The "Elec. Ry. Gaz.," Aug. 31, publishes the first installment of a series of articles by Mr. Hermann Hering; he will describe very extended tests made in Baltimore from which he deduces data and conclusions relating to the economical operation of electric railways, which are of great practical value to those engaged in traction work; the tests were made to determine the performance of electric cars of various kinds under definite conditions of load, speed, grade, track, etc., with a view to obtaining empirical data for these conditions; the tests include the following: the determination of the traction coefficient; the determination of the performance of cars run alone over the entire route; the determination of the performance of several different cars on uniform grades at stated speeds under various loads and with different positions of the controller; the determination of the performance of the same cars run on two different roads under similar and different conditions, and lastly, tests with special testing cars in regular service; he also gives results of tests of a car on a road before and after it was double tracked and improved; much of the data will be given in the form of curves, many of which are quite elaborate and very interesting. The present portion is introductory.

Synchronizing Railway Motors.—The Thomson & Rice method is described and illustrated in the "Elec. Eng.," Sept. 4; it is intended to prevent one or the other of the two motors from racing and it practically locks them together by an electric system. A series, continuous current motor drives the axle as usual; it is connected in series with the magnets of two multiphase machines and thence to ground; the armatures of the multiphase machines are electrically connected and are mechanically secured to the two car axles; in the diagram, the multiphase armatures are shown to be simply connected electrically but in the description it is said that the continuous-current armature "acts also as a generator of multiphase currents through the collecting rings and leads"; presumably the former and not the latter is correct, as it is stated that when the speeds of the two multiphase armatures are the same the two E. M. Fs. balance and no current passes, but if the speeds are different one machine generates a current which drives the other as a motor tending to maintain synchronism of rotation. The arrangement is said to be particularly well adapted to high-power locomotives as required in trunk line business; the motors might be located on different parts of a train and their synchronism maintained.

Accumulator Traction.—Prof. Anthony, in the "Elec. Jour." (Chicago), Sept. 1, discusses why storage batteries have made such slow progress in this country. The great drawback, he believes, has been the great first cost and the rapid deterioration, the latter being due partly at least to the effort to reduce the cost and secure lightness; he believes the present form of "chloride" battery is the best of the lead oxide batteries used in this country. He discusses the question of trolley or conduit vs. accumulator traction, and concludes that the cost of the station plant for charging the batteries would not be very different from that for a direct system, though it would be somewhat smaller if a sufficient number of sets of batteries were furnished to level the load line, but he believes that these batteries would cost more than the amount saved in the plant; the motor equipment would be the same; the battery equipment offsets the saving in the line or conduit; it would depend on the conditions in each special case as to which of these would be the greater; the loss of energy would not differ greatly in the two methods, although for short lines the loss would be against the battery; the cost of maintenance of the battery would be much greater than that of a well-constructed line. As an "off-hand guess," he concludes that the conditions would need to be all favorable to the storage battery in order that it might prove its superiority from a commercial standpoint on the ordinary lines.

Car Wiring.—A good diagram, showing the wiring according to the Westinghouse plan, is published in the "Elec. Eng.," Sept. 4.

Electric Railways in Maryland.—The "Amer. Eng." for September publishes a map of the electric roads in Maryland, and discusses their effects and the projected extensions.

Detroit.—The "St. Ry. Jour." for September contains a well illustrated description of the plant of the Detroit Citizens' Street Railway Company, limited chiefly to the power house.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Electrical Supply at 230 Volts.—The Lond. "Elec.," Aug. 23, reprints an article from the Lond. "Engineer," describing a recent change made in the Bradford station. This station formerly used a three-wire continuous-current system, with 115 volts on each side; it was necessary to increase the output of the station, but on account of the Board of Trade restrictions this could not be done by raising the voltage; it was therefore decided that all new consumers be connected to the outside mains only, thus using lamps at 230 volts; this change could be made without interfering with the operation of the rest of the system; it is intended in future to make it a three-wire system, with 230 volts on each side; the most serious result to the consumer is that he is no longer enabled to use 8-cp lamps, which are so largely used in England at present.

Electric Light Stations in Japan.—The "Elec. Friend" (Japan) for July gives the following dividends, which were declared for the half year from January to June, 1895: Tokio, 8 per cent.; Yokohama, 9 per cent.; Kyoto (using water power), 18 per cent.; Osaka, 12 per cent.; Tokio Gas Company, 14 per cent.; Tokio Horse Car Company, 22 per cent. The same issue contains the following results, obtained at the Tokio lighting station, using Japanese coal and Edison, Brush and Hopkinson machin-

ery: 6.6 pounds per hp-hour; 1.3 pounds per ampere-hour (voltage not given).

Rectifier.—An illustration of the Ferranti rectifier used in the Edinburgh station (see Digest last week) is published in the "Elec. Rev.," Sept. 4.

WIRES, WIRING AND CONDUITS.

Specifying Insulation Resistance.—Mr. Raworth, in the Lond. "Elec. Rev.," Aug. 23, suggests the need of some better means of specifying the qualities of insulation of wires than by the number of megohms per mile. What is wanted is a definition of the resistance of the dielectric reduced to "Preece's quadrant cube," or to one acre one inch thick or any other suitable and convenient standard. Also, a definition of the thickness of the insulation, and lastly a test to show that the cables possess an insulation resistance in megohms corresponding with the quality, thickness and area of the dielectric.

Overhead Lines of Selenium-Bronze Wire.—The "Electro-Techniker," Aug. 15, contains a number of tables giving the deflection of spans of this wire for different lengths of span, temperatures and tensions. The wire is that made by Lazare Weiler, of Paris. A few hints regarding the handling of this wire are also given.

Porcelain as an Insulator.—Mr. Dobbs, in the "Elec. Eng.," Sept. 4, questions whether the growing impression that porcelain is better than glass for high voltages is correct, giving his experiences. He noticed that the glazing seemed to crack when exposed to the weather. In a number of cases he found that red streaks of rust were left on the porcelain insulators, proving that either the porcelain contained some impurity or that there was slight electrolysis caused by leaks.

ELECTRO-PHYSICS AND MAGNETISM.

Phase Difference in Alternate-Current Electrolysis.—In an article on this subject by Mr. Cooper, in the Lond. "Elec.," Aug. 23, he summarizes briefly the recent papers by Peukert (see Digest, June 29), and Dobrowolsky (see Digest, July 20 and Aug. 17), and adds some remarks of his own. He shows the practical bearing which this question has on the testing of alternators for which purpose a water resistance is often used; the question arises, does the product of the volts and the amperes give accurately the value of the power expended; in certain cases it evidently does and he believes that it is not probable that serious errors will arise in practice provided the electrodes are so placed that the voltage loss due to ohmic resistance is large as compared with that due to the polarization; in other words, the number of tubs in series should be as small as possible and the electrodes should be far apart, with a high current density. Referring to alternate-current electrolysis he states that much depends on the value of the impressed voltage; if it is below what is required to effect decomposition, then a voltameter would be expected to act simply as a condenser; if above this critical value but does not exceed the limiting value of polarization, there would be a condenser effect followed by a polarization effect, giving rise to a voltage in quarter phase with that due to ohmic resistance; if the impressed voltage exceeds that of polarization, the changes in the last case are followed at the end of each alternation by a period during which the products of decomposition are readily evolved if gaseous but the resulting voltage is then not simply in quarter phase with the other component; this he shows with the aid of three curves.

Unipolar Induction.—The "Elek. Zeit., Aug. 15, contains an article by Dr. Weber, a translation of which, with the illustrations, appears in the Lond. "Elec. Eng.," Aug. 23. The article refers to the much discussed question of whether the magnetic lines of a cylindrical magnet revolve or remain at rest when the magnet is revolving on its axis. He refers to the recent article by Mr. Lecher (see Digest, Feb. 2 and June 22), which he considers to be the most thorough discussion of the subject so far; he discusses some of his conclusions and expresses disagreement with a recent article by Prof. Arnold (see Digest, April 6); he (Weber) then endeavors to show by argument, as distinguished from tests, that the field of a magnet remains at rest while the magnet itself moves; he claims that there is nothing strained in that proposition; one should not conceive lines of force as being something which attaches itself to material; they should be considered only as representative of a condition of the ether; he believes that no reason exists why the field should revolve with the magnet. He applies his arguments to alternate-current machines having teeth on the armature and on the field, in which it is of great practical importance to know whether lines of force revolve or not.

Magnetic Observations.—The Lond. "Elec.," Aug. 23, contains a note referring to a recent paper by Mr. La Grange in "Comptes Rendus," June 17, in which he showed that in making declination observations by the aid of magnets of very different moments, systematic differences occurred in the values obtained and that a diminution, within certain limits, of the magnetic moment of the magnet causes an increase in the observed declination.

Action of the Electric Current in Aluminium Wires.—A translation of the article abstracted in the Digest last week, is published, with illustrations, in the Lond. "Elec. Rev.," Aug. 23.

An Electromagnetic Effect.—The complete paper by Mr. Bowden, which was abstracted in the Digest, April 2, is published with the illustrations in the Lond. "Elec.," Aug. 24.

Rotating Magnetic Fields.—The "Elec. Jour." (Chicago), Sept. 1, contains an article by Prof. Carhart including a large number of illustrations, giving the results of experiments made to determine to what extent the conclusion holds, that the magnetizing forces due to two or three-phase currents around an iron ring are simple harmonic vector quantities, and that they combine to produce a single resultant magnetizing force constant in value, and rotating with uniform speed around the ring. The apparatus for generating the currents was the well-known one consisting of three vertical zinc rods symmetrically placed with respect to the centre around which they revolve, in an electrolyte through which a current is passing between two diametrically opposite electrodes; the currents taken from the three rods by means of sliding ring contacts will then form a system of three-phase currents, which he shows are nearly sine curves with equal maximum values; when four rods are used two-phase currents are produced; the currents are shunted from that which passes through the electrolyte; the electrodes are all of zinc and the solution is zinc sulphate; a graduated circle fixed to the top of the jar enables the rods to be set in any desired position, so as to produce three continuous currents whose values are equal to the instantaneous values of the three-phase currents corresponding to that position. These continuous currents were passed through a Gramme-ring winding around a laminated iron ring; the magnetic fields produced around this ring were shown by iron filings whose positions were photographed, reproductions of 25 of which are given. From this he finds that one of the poles moves at a time, and he describes the motion as similar to that of a measuring worm; "it stretches out in advance 120 degrees and then gathers itself up from the rear into a compact pole. And this operation goes on at opposite sides of the ring alternately. If we consider the neutral or equatorial plane of the ring, that appears to pass through the centre of the ring and perhaps revolves with a uniform motion." With two-phase currents he finds that there is no stationary pole but the motion goes forward by the same measuring-worm process. He concludes that it is evident that there is no difference in the character of the changes going on in the rotary magnetic field when produced by two-phase and three-phase currents and that the superiority of either over the other must be decided upon other grounds.

Thermoelectric Currents from Galena.—Although galena is generally placed at the positive end of the thermoelectric series, it sometimes is found to be negative; some experiments undertaken to investigate this discrepancy are described in the "Elec. Eng.," Sept. 4; it was found that when sulphur was present in the galena it was negative but after that sulphur had been burned away it was positive; when first freed of the uncombined sulphur, galena was always found to be positive. The experiments are claimed to show that the action is the same as in voltaic cells, the direction of the current being determined by the nature of the chemical action; (in a true thermo-couple, however, there is, or ought to be, no chemical action.)

ELECTRO-CHEMISTRY AND BATTERIES.

Indirect Electrolysis.—In the Lond. "Elec.," Aug. 23, Mr. Andreoli replies to the recent criticisms of Mr. Rawson (see Digest, last week), and shows that indirect electrolysis is a different process than the well-known ones and that it has nothing to do with either the copper refining or the amalgamating process mentioned. He describes the process of indirect electrolysis (see Digest, Aug. 3), and gives some illustrations. The cell is divided into three compartments by two porous diaphragms with electrodes in the two outer compartments only; these are filled with a chloride of sodium solution, while the centre compartment contains a bi-sulphite solution in which zinc or other suitable metallic plates are immersed; when the current passes, the liquid in the centre compartment is transformed into hyposulphite of sodium, a very powerful bleaching agent. For depositing gold he uses chloride of sodium solution in the end compartments, while the central one contains cyanide of gold and potassium solution, which yields its metal on perforated sheets of zinc or lead, which almost fill the compartments but are not connected to any of the poles; the gold solution may be strong or weak, but the deposition will continue until the solution is practically exhausted, say to the extent of 99 per cent. "I do not say that this indirect electrolysis, as a practical process, is good or not"; but he believes that there is novelty, originality and utility in it. Editorially it is claimed that as there is no data regarding the resistance of the bath, the current density or the voltage, it is not possible to form any definite opinion as to the novelty of the discovery.

Electrolytic Action of Intermittent Currents.—Dr. Koehn in the "Zeit. f. Electrochem.," Aug. 20, refers to the recent statement of Mr. Pollak to the effect that he found that there appeared to be an increase in the electrolytic action when the current is intermittent; the present writer states that he has often pointed out that intermittent currents promote the dissolution of the ions and prevent secondary reactions. He obtained traces of metallic aluminum by passing an intermittent current through a solution of aluminum sulphate; with zinc he found that intermittent currents gave a very good and hard metallic coating under conditions which would otherwise have given very unfavorable results.

Separating Gold and Silver.—The process used at the Frankfort Works (Germany) is briefly described in the Lond. "Elec.," Aug. 23. The auriferous silver is cast into plates which are enclosed in linen bags and made the anodes in a weak solution of silver nitrate, made acid with nitric acid; the cathode consisting of thin plates of fine silver, are suspended without covering in the bath and below them is a tray with a linen bottom; a high current density is used and the silver is deposited incoherently after

which it is scraped off into the tray; the linen bags around the anodes are emptied of their residual gold once or twice a week. If copper is present it will remain in the solution provided some fresh nitric acid is added from time to time.

Primary Battery.—A recent paper by Mr. Morisot, read at the Bordeaux Congress, describing a new form of battery, is abstracted in "L'Eclairage Elec.," Aug. 17. The positive pole is made of retort carbon placed in the exterior department in a depolarizing liquid made of one volume of sulphuric acid, three volumes of a saturated solution, bichromate of potash; crystals of this salt suitably suspended in the top of the liquid keep it saturated; in this is placed a porous cup containing a solution of caustic soda of a density of about 1.05; the negative pole consists of amalgamated zinc in a second porous cup which is placed in the first, the zinc being in concentrated solution of caustic soda of a density of about 1.25. The E. M. F. is 2.5 volts at the start and will be maintained at over 2.4 volts during 10 hours; the internal resistance is 0.8 ohms; experiments were made with a cell containing 600 cu. cm. of the depolarizing liquid, 130 of the dilute soda and 110 of the concentrated soda, and a current of 0.432 amperes was obtained with an external resistance of 5 ohms and 0.220 with 10 ohms. The increase of E. M. F. over that of other cells was due to placing the zinc in an alkaline instead of an acid solution; the same change made in the Bunsen cell would give it an E. M. F. of 2.25 instead of 1.85 while in the Daniell cell it will raise the E. M. F. from 1.1 to 1.6; the local action is much less than in the Poggendorff cell or in those containing acids; the cell is supposed to be used only for a few hours at a time and is intended more particularly for lecture purposes.

The same issue contains a note referring to the output of the Junius cell; the positive electrode is made of carbon in a porous cup containing the depolarizing solid which consists of bionoxide of manganese or of barium; the negative is formed of several cylinders of zinc in a solution of soda; the E. M. F. is 1.6 volts, which falls to 1.33 when the cell is discharged through 10 ohms; the internal resistance is 1.15 to 0.56; it is claimed that there is practically no consumption of zinc on open circuit.

Accumulator.—A paper, by Mr. Margaine, read at the recent Congress at Bordeaux, referring more particularly to the Blot accumulator, is given in abstract in "L'Eclairage Elec.," Aug. 17. He compares the different qualities of accumulators of the Planté and Faure types; in all of the latter the mechanical deformations produce imperfect contact between the electrode and the oxide, which becomes worse and worse; the oxides are not well utilized as Faure himself showed that the action penetrated only 0.5 mm in a thickness of 5 mm showing that 90 per cent. of the active material does not contribute to the capacity of the accumulator; these objections are all overcome in the Planté form in which the contact is good and the material entirely utilized. He then describes, although not very clearly, the Blot accumulator of the Planté type, which appears to be made of bands of lead laid in a frame of antimony lead; the disposition is such that it is claimed that there is no buckling of the plates; at a normal rate of discharge the capacity is 10 ampere-hours per kg and double this value can be attained after having been in use for some time.

Accumulators.—A paper by Dr. Sieg, describing at some length the new form of Hagen accumulator, including data, is reprinted in the "Elek. Zeit.," Aug. 15; by an ingenious construction of the mould for casting the frames, the two halves of the mould are withdrawn diagonally so as to leave a double grid which is flat on the outside and beveled on the inside surfaces; it is therefore impossible for the material with which the internal spaces have been filled to drop out unless it has crumbled into small pieces; an illustration of the mould and the plate are given.

Electrochemical Industry.—According to a German paper, a company with a capital of $60,000 has been formed in Turgi, Switzerland, whose object is to make commercial applications of all kinds of electrochemical processes.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Meters.—A short paper by Mr. Hummel on motor meters is reprinted in the "Elek. Zeit.," Aug. 15. As far as simplicity and reliability are concerned, he states that it has not yet been possible to construct electric meters which will even approach the usual gas meters. He limits himself in the present paper to single-phase alternating currents; the Blathy meter was one of the earliest and is to-day still one of the best; regarding the Schallenberger and Duncan meters he states that they have the advantage that they are not dependent on the use of constant shunt currents, but they have the disadvantage, that no account is taken of the phase shifting by induction resistance, that the maximum power of their motors is very small and that it decreases approximately with the square of the current; it is furthermore hardly possible with their combination to obtain proportionality between current and the number of revolutions; there are errors in the lower values, as the motor does not begin to revolve until it is capable of overcoming the resistances. Eight years ago he worked in an entirely different line by combining a continuous current motor with a copper disc rotating in a constant magnetic field, a combination which is now used in nearly 100,000 meters; for alternating currents this has the great advantage, that, as an absolute wattmeter, it takes an accurate account of the phase shifting; there is a disadvantage in that it requires the use of brushes. He then describes his new apparatus which is only for single-phase alternating currents; it contains a motor operated by means of an artificial phase caused by a damping disc combined with a constant magnetic field; the armature consists of a bell-shaped piece of copper; the armature iron is stationary; the inducing system contains an iron ring with only four teeth; the main winding is on the Gramme principle, the shunt winding consists of frames separately wound and then placed in the grooves; the phase shifting is produced by an induction resistance which is adjustable and by means of which the speed of the motor can be so adjusted that the kilowatt-hours can be read off directly; by taking great care in the construction, he has produced a meter which may be relied upon absolutely for years like a gas meter; the consumption in the shunt circuit at a high phase difference has been reduced to nearly one watt. He describes how the apparatus may be simplified, but he prefers the more complicated and more correct construction. No illustrations are given.

Measuring Currents of Low and High Frequency.—A note by Dr. d'Arsonval is published in the "Rev. Int. d'Electrotheraphie" for July. For measuring high frequency currents it is not possible to use even a U-shaped wire, as the sparks are apt to pass across the terminals on account of the self-induction of the loop. He therefore measures such currents by means of a single small metallic wire stretched horizontally and secured at the two extremities. The discharge passing through this wire heats it and thereby expands it. The expansion is measured by attaching another wire to the middle point and applying a slight tension to it, the movement of this wire therefore being a measure of the elongation of the first wire. The movements of the second wire may then be magnified in a lantern or otherwise. A third wire perpendicular to the second might be used, but he considers it unnecessary. The apparatus is calibrated by passing a known steady current through it. This apparatus measures the mean intensity of continuous or alternating currents whatever be the frequency, and the action is sufficiently rapid to measure or record variable currents. He used a silver wire 0.1 to 0.2 mm in diameter and 20 cm long, placed in a bath of petroleum. The reflections may be recorded on a smoked drum. The apparatus is very sensitive and the deflections are produced very rapidly.

Eliminating E. M. Fs. in the Measurement of Resistance.—A recent paper by Dr. Broca is abstracted in "L'Eclairage Elec.," Aug. 17. Having had occasion to measure the resistance of carbon, he found that there was always present an E. M. F. of 0.3 to 0.5 volts, which interferes with the resistance measurements made by the Wheatstone bridge method; he then describes a method which is analogous to that used for measuring the resistance of earth contacts consisting of an ordinary Wheatstone bridge method in which two measurements are made, the battery in the two cases being reversed. He discusses mathematically the method in which the E. M. F. of the battery in the Wheatstone bridge or the resistance of the branch in which it is placed, is varied; knowing this change in voltage or resistance he shows how it is possible to calculate the true resistance and the E. M. F. of the circuit whose resistance is being measured; the method is simplified if a galvanometer, measuring the current, is placed in this diagonal; it appears, however, that at best the method is somewhat troublesome; he prefers to use, for this, a d'Arsonval galvanometer in which the coil is suspended by means of a spiral of silver wire.

The Potentiometer and Its Uses.—Mr. Crapper's article is concluded in Lond. "Elec. Eng.," Aug. 23; he discusses measuring higher E. M. Fs., standardizing volt and ammeters, measuring resistance and conductivity of wires.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Telephone Numbers Used as Telegragh Addresses.—The "Elek. Zeit.," Aug. 15, states that the Swedish telegraph department has set an example which is well worth following; telephone subscribers are hereafter to use their telephone numbers as their addresses in sending telegrams; a telegram addressed in this way will then, as a rule, be sent by telephone from the telegraph station, but if for some reason it is not duly received, it will then be sent by messenger; it is thought that by this means much time will be saved in sending telegraph messages.

Telephotograph.—A Swedish invention with this name is described briefly in the Lond. "Elec. Eng.," Aug. 23; it is claimed to do for the eye what the telephone does for the ear. In the transmitter a fine point of selenium is made to move in a plane mechanically, "in such a manner that it, moving within a limited compass of this plane repeatedly forward and backward, describes a spiral consisting of very close windings"; a current passes through the point and its strength will vary according to the light to which the point is exposed; the receiver is constructed similarly, "except that a very susceptible incandescent light has been substituted for the selenium point," the intensity of which will vary with the light to which the selenium point is exposed, the light itself being made to move in a similar manner to the point. The picture in the receiver may be made visible either by photography or by being directly looked at through some magnifier; the rapidity of the movement of the point "must not allow of a greater interval than about one eighth of a second," so that the eye receives the impression in a continuous picture.

Railroad Signal.—In the "Elek. Zeit.," Aug. 22, Mr. Teirich describes at some length, with the aid of a large number of diagrams, the Loieosky system of electrically operated distant signals which combine the advantages of the operation by means of alternating currents and closed cir-

cuit continuous currents in such a way that any failure in the line will set the signals to danger.

Machine Telegraphy.—The Delany system is described at some length in the "Elec. Eng.," Sept. 4. To show the improvement claimed over the present system, it is said that a single copper wire of 300 pounds to the mile between New York and Philadelphia worked by this system will carry 3,000 words per minute perfectly without any chance whatever for mistakes; to do this by the present hand system would require 38 wires worked quadruplex or 152 circuits at nearly 20 words per minute each.

Telephone as a Disseminator of Disease.—The "Pop. Sc. Mo." for September states that the medical journals of Paris are agitating this question; it is suggested that it may be necessary to adopt some device by which the danger to infection from the mouthpiece, which many people allow to touch the lips, can be avoided.

Storage Batteries in Telegraphy.—Mr. Macral, in the "Elec. Eng.," Sept. 4, describes, with the aid of some good diagrams, the systems used in Baltimore and Atlanta.

MISCELLANEOUS.

Production of Concentrated Ozone and Its Effect on Germs.—The "Rev. Int. d'Electrotheraphie" for July reprints a recent paper by Dr. d'Arsonval on this subject. The idea that it is easy to produce ozone in large quantities by means of electrostatic machines, he states, is not correct, as it requires nearly 15 calories to form 24 grammes of ozone, which amount of energy corresponds to 6,375 km meters, which can hardly be furnished by an influence machine generating only several tenths of a km meter per second; with the use of the Berthelot apparatus and a large Ruhmkorff coil giving a 15 to 20 cm spark, one can obtain about one decigram in an hour. The temperature of the gas plays an important part in the production of ozone, the lower the temperature the more ozone is formed; he therefore uses his apparatus at —40°C. or even —60° C. and under these conditions one can obtain ozonized oxygen containing more than 40 per cent. of ozone; he furthermore uses the coil for operating high frequency apparatus giving a 10-cm spark, the current being 125 milliamperes, under which conditions he obtains large quantities of ozone; he states that the production is incomparably greater by using high frequency, high tension currents; it is still better to use an alternator for operating the Ruhmkorff coil; he prefers the Berthelot ozone apparatus modified by using two fine platinum wires parallel to each other and about 6 or 8 cm apart, care being taken to avoid the production of heat sparks.

Electric Devices for Steering Ships.—A recent lecture by Mr. Gentsch, describing several forms of apparatus, is reprinted with illustrations in the "Elek. Anz.," Aug. 25.

Lightning Indicator.—An illustration, accompanied by a description, of the instrument which was described in the Digest, July 13, is published in the Lond. "Elec.," Aug. 23.

Electric Weed Killer.—The "Elec. Jour." (Chicago), Sept. 1, contains a description by Mr. Armstrong of his experiments in killing weeds on railroad tracks, a brief description of which was given in the Digest, May 18; the present article seems to refer to later tests. Railroad companies in the United States have found that it costs about $40 per mile per year to remove grasses and weeds from their roads; the inventor of the present method is Capt. Sharp; the apparatus consists of a high-speed automatic engine on a box car belted to a 60-kw alternator and provided with a switchboard and instruments; there are eight step-up transformers; the steam is obtained from the locomotive which propels the car; the transformers are immersed in coal oil which he finds far superior to any other for the reason that a spark through the heavier grades of oils forms a carbon pencil, through which increasing currents will flow, but no such result was obtained with coal oil; the brush extending across the track was made up of short sections of street car track brushes (presumably of steel) and these were connected to the circuit, the other end of which was grounded; the voltage was 40,000; small arcs were established between the brush and the weeds as the former moved over the latter, the strength of the arcs varying in proportion to the juicyness of the plants; in every case the plant was destroyed, the cellulous structure being broken down or else the plant was destroyed by the heat; those which had fewest roots were most quickly killed; the brushes were divided into sections in order to prevent all the current from going through some of the plants; 5,000 volts was found sufficient for young vegetation, which later in the season required 10 to 20 thousand volts; a machine of proper size can operate at the rate of 60 miles a day of 10 hours, at a cost, including everything, of not over $200, while by the old method it would cost $2,400.

In the same issue Prof. Dolbear in referring to the subject of killing weeds by electricity, states that the demand for apparatus for doing this would be considerable and he calls the attention of manufacturing companies to the desirability of constructing such apparatus; for heavy weeds he thinks 4,000 to 5,000 volts would be necessary; a truck carrying eight to ten secondary cells with a mechanical alternator, and a high voltage transformer would be sufficient for some places; for larger fields a portable steam engine might be necessary; the best time for doing it would be in dry weather when the chief conducting material is the sap in the plant; the disruption which follows continues to the tips of the roots. "It is to be hoped that some enterprising company will undertake to supply the country with the proper apparatus."

Insulating Properties of Oils.—The "Sibley Jour." for June contains an abstract of a thesis by Mr. Bell in which are described with the aid of illustrations a series of tests to determine the insulating properties of oils. A Wimshurst machine was used; samples were tested in their original condition, after air and moisture had been removed and after some lampblack had been mixed with them; in each case the leakage, the striking distances for different pressures, and the effect of a passage of sparks, were determined; the table of results gives among other things the voltage required to rupture one mil thickness of the different oils, that is, the quantity called the gradient; unfortunately the oils are indicated merely by numbers and the explanation of the table is not very clear. In conclusion he states that it is quite apparent that oils are very valuable insulator their disruptive strength in some instances being many times that of air.

Action of the Soil on Poles.—A note from the "Annual" of the University of Michigan, reprinted in the "Elec. Eng.," Sept. 4, gives some information regarding iron and wooden poles. Ordinary 4-inch gas pipe used as trolley poles set in concrete without other coating, is corroded through about 10 inches below the surface in about three years; the life of white cedar poles in clay soil is about 13 years, without protection of treatment; Norway pine poles in the same soil last about 30 years, but they rot very soon in sandy soil; the more pitchy ones decay first; winter-cut poles and those cut in summer with the sap wood removed are more lasting than those containing green sap wood. Steam pipes covered with a non-conductor and buried in the ground will not corrode while a similar hot water return pipe corrodes from the outside by rusting.

Biographical.—The "West. Elec.," Sept. 7, publishes a brief biography with portrait of Prof. W. M. Stine. The "Elec. Jour." (Chicago) publishes a large portrait of Prof. Elisha Gray.

New Books.

COURS ELEMENTAIRE D'ELECTRICITE, LOIS EXPERIMENTALES ET PRINCIPES GENERAUX. INTRODUCTION A L'ELECTROTECHNIQUE. By Prof. M. B. Brunhes. Paris: Gauthier-Villarrs et Fils. 265 pages, 137 illustrations. Price, $1.50.

The author, in this volume, presents an amplified set of notes on his course of lectures on theoretical electricity before the first-year section of civil engineering students in the Industrial Institute of the North of France. The experimental laws and general principles necessary as an introduction to the study of electrotechnics proper are here presented in as simple a manner as possible consistent with a rigorously scientific treatment. Where possible the use of the calculus has been avoided, and appears only in connection with induction phenomena. The following are the titles of the seven chapters: Current; Magnetism, Electromagnetism; Electrical Measurements; Induction; Electrical Units; Principles of Electrotechnics. In the first chapter the reader is made acquainted with the electric current through its electrolytic effects. The idea of resistance is derived from the law of Joule, and the idea of E. M. F. from Ohm's law. In the second chapter an interesting section on the general properties of Newtonian forces is introduced. The chapter on electrical measurements is weak. Only a few of the many methods of determining the various electrical magnitudes are given, and these are by no means typical. There is a short appendix on the second law of thermodynamics at the end of the book. The typography is good and the illustrations clear, although we occasionally meet with an old friend, *e. g.*, Barlow's wheel.

HANDBOOK OF PRACTICAL MECHANICS. For use in the shop and draughting room. By Charles H. Saunders, Ph.D. (Yale). Hartford: Student Publishing Company. 116 pages, 8 illustrations. Price, $1.

This book is intended for use in the shop and draughting room. It contains tables of logarithms and the trigonometric functions; directions for making calculations and designing all kinds of gears, cams, screws, bolts and nuts; quick methods of lathe adjustments. A few important workshop recipes are given, as well as methods of calculating shaftings, belts and pulleys.

The Steam Turbine on the Pacific Coast.

BY W. F. C. HASSON.

The following facts are of interest in the history of the development of the steam turbine:

In 1883, Mr. Robert Hewson, a resident of Oakland, Cal., began a series of experiments with an impulse water motor. The novelty of the motor consisted in the arrangement of buckets or vanes secured to the face of a disc, and so arranged that a number of small jets of water could be admitted at the side of the wheel casing. The results obtained were so satisfactory that a number of wheels were manufactured and used for the purpose of running light machinery. The demand, however, for such a motor was at that time limited and its manufacture was discontinued.

Mr. Hewson then turned his attention to the application of gas under pressure as a means of operating the motor. A gas generator and small motor were placed in a 20-foot launch, the exhaust gas being used for fuel. The construction of the gas generator, however, proved to be very faulty, and the experiment was abandoned.

The next step was the application of steam as a motive power, and a motor was built on the same general principles as the original one designed for water power. A 26-foot launch was fitted with an upright boiler, having a capacity of three horse-power, and a new motor was built for this purpose. The results obtained were very satisfactory, and a speed of about six miles an hour was attained. A number of improvements were suggested by this experience, and a new and larger turbine was designed. This turbine was 24 inches in diameter, and made 2,600 revolutions per minute. The motor was geared to the propeller shaft in a ratio of eight to one, and, with the same boat and boiler and a steam pressure of from 140 to 160 pounds, a speed of eight miles an hour was obtained. An inner row of buckets, faced in the opposite direction, was set in the wheel, and the reverse motion thus obtained. This launch, known as the *Volunteer*, was in use for a number of years.

Illness prevented Mr. Hewson from carrying further his experiments at that time. Later, a 30-inch reversible turbine was fitted in a 32-foot launch, supplied with an eight-hp marine boiler, and, with steam at 160 pounds pressure, a speed of nine miles was obtained over the measured mile in San Francisco Bay. Representatives of the Union Iron Works and other prominent people took trips on the boat. While anchored in an exposed position the boat foundered in a heavy gale.

Mr. Hewson saw the advisability of reducing the speed of rotation of the wheel. To this end a wheel seven feet in diameter was designed. Through faulty design and bad material, this wheel flew to pieces while being tested. This accident naturally created a lack of confidence in the wheel, and it was some time before Mr. Hewson could get backing enabling him to make further developments.

Finally a five-foot turbine was designed and built at the National Iron Works in San Francisco, and placed in the Starr Flour Mills at Port Costa. The motor was here placed in a very disadvantageous position, being 460 feet away from the boiler, to which there was only a four-inch pipe, while the connections to the mill machinery were made by a complicated series of counter shafting and belts. The condensation in the pipe and the loss in transmission decreased to a great extent the apparent efficiency of the motor. In 1893, a 30-inch steam turbine was exhibited at the Mechanics' Institute Fair in San Francisco, and there used for the operation of two centrifugal pumps.

There has apparently been an undercurrent of opposition from the builders of machinery to the development of the steam turbine, and Mr. Hewson claims that he has often found it difficult to have his machines constructed. However this may be, he has persistently believed in the success of the motor, and is now at work developing it with renewed energy.

Up to this time, with the exception of the steam launch engines, all of the turbines constructed had but a single row of buckets. Mr. Hewson has now designed, and had constructed, a wheel having a number of concentric rows of buckets, and a system of receivers proportioned after the manner of the cylinders of a multipolar expansion engine. This turbine will shortly be thoroughly tested, and, if successful, will undoubtedly lead to further development.

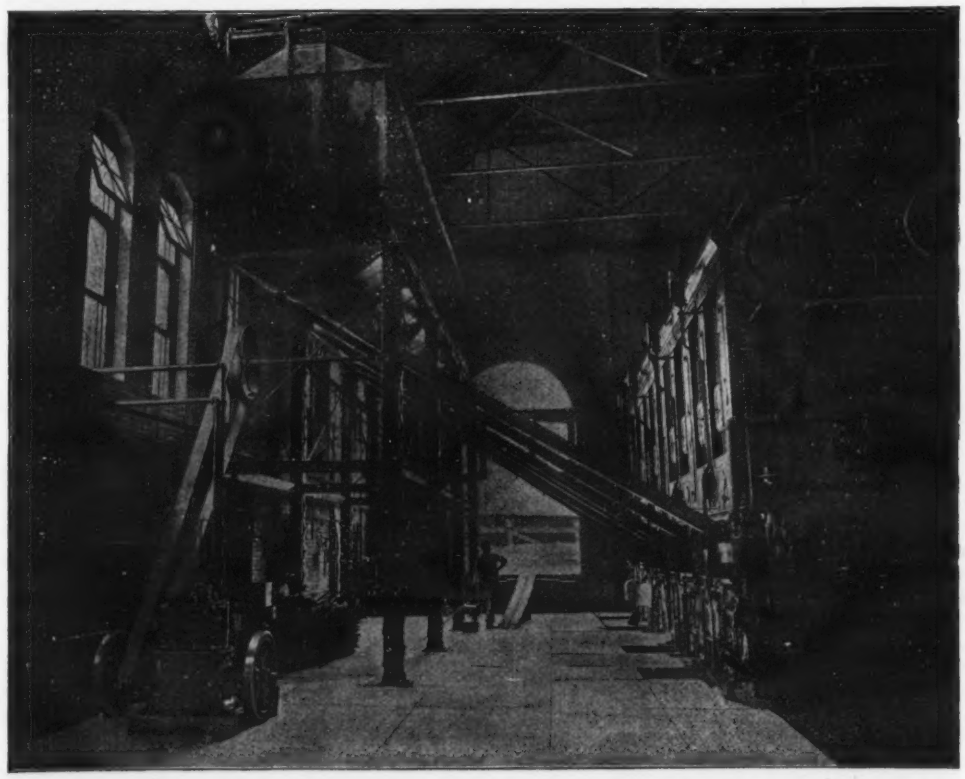
An Electric Boat Hoist.

A new application of electric power has recently been made in Ottawa, Ont., in the shape of an elevator for boats, constructed by the Ottawa Canoe Club. This club has its boat-house built on a ledge of rock and against a high bluff on the Ottawa River. The river rises every Spring to a height of from 10 to 15 feet above the average Summer level, consequently the club-house had to be perched high up the hill. In the Summer season the lower sills lie some 18 feet above the water, and under these conditions the transfer of the skiffs and canoes between the boat-house and the water was a slow and laborious process. This season the club decided to overcome the difficulty by the installation of an elevator or "lift," operated by electricity, and Mr. A. A. Dion, general superintendent of the Ottawa Electric Company, who is a member of the club, designed and had constructed the apparatus which is now used. Its operation is perfect; the boats are handled quickly and safely, and are less strained than they were when moved by hand.

The apparatus consists, broadly, of a frame gangway 10 feet wide by 32 feet long, a skeleton car, an ordinary worm-geared hoisting drum, and a 3-kw 500-volt Edison motor. The gangway, which is made of two heavy timbers with lateral ties and braces, forms an inclined plane extending from the lower platform of the boat-house to the water, into which it dips at an angle of about 45 degrees. On the inner face of the side timbers of this gangway, rails of 2-inch angle-iron are fastened. The car which runs upon this track consists of an oblong bed frame from two sides of which arms made of 2-inch by ½-inch iron, looped, extend upward at an angle of about 90 degrees from the bed-frame. Slings made of 3-inch rubber belting are suspended between the top corners of the bed frame and the tops of the iron arms forming two flexible, elastic supporters about nine feet apart, intended to receive the boat; this carriage is mounted on four independent 4-inch cast-iron flanged wheels. There are also two wheels running under the rails to prevent the car leaving the track. The carriage is attached to the drum by a ¾-inch steel cable running over sheaves to the back of the building, where the hoisting apparatus is placed, under the floor. The motor is belted to a countershaft which is, in turn, belted to the shaft carrying the worm. When the car is at the bottom of the gangway its highest part stands about one foot under water, so that a boat may be floated on and off. When at the top its highest part stands over and inside the edge of the platform, so that a boat may be lifted on and off easily. It will be understood that the boats lay in the slings at right angles to the line of traction. The speed of the car is about 75 feet per minute. The car stops automatically at the top and bottom of its allotted course, the lower stop being adjustable to suit the water level. The automatic stop device is an ingenious modification of the well-known arrangement of a nut moving along a screw extending from the drum shaft, and is very positive in its action.

Jeffrey Coal-Handling Machinery.

We illustrate herewith an installation of coal-handling machinery, recently erected by the Jeffrey Manufacturing Company, of Columbus, O., in the new power station of the Columbus Central Street Railway Company at the same place. This power station is one of the finest of its kind, not only from an architectural standpoint, but also in its mechanical equipment. The coal, which is usually nut, slack or pea, is brought in ordinary railway cars upon the side track, immediately adjoining the power house. The coal is then discharged into a large V-shaped hopper



Coal-Handling Plant in Power Station.

of a size to admit the storage of ten cars; from this hopper the coal is taken by a conveyor, carried under the roadway, a distance of about 100 feet, and is discharged into a bucket elevator inside the power house. It is then elevated to a height of 35 feet and is discharged into another conveyor, located upon the top of the storage hoppers. The coal hoppers

are connected with the automatic stokers by specially arranged spouts, and by means of valves and levers, which are controlled by the man in charge, the coal being fed into the stokers as may be required. The coal hoppers are built of heavy sheet steel, supported by wrought-iron pillars. A small stationary engine drives this coal-handling machinery, while the whole plant is of a capacity of more than double the present requirements of the power plant, which is now equipped with boiler capacity of 1,500 hp.

A New Alternator.

The alternating-current generator which we illustrate, manufactured by the Warren Electric Company, 1315 Old Colony Building, Chicago, has for its main features slow speed, low frequency (60 periods per second), and a construction permitting of various changes in voltages without in any manner changing the machine or its coils. In its design the simplest possible form of construction has been followed, the idea being to produce a generator embodying the latest idea in alternating design, involving high efficiency, a perfect electrical and mechanical balance, and the highest economy in regulation and operation, as well as a machine

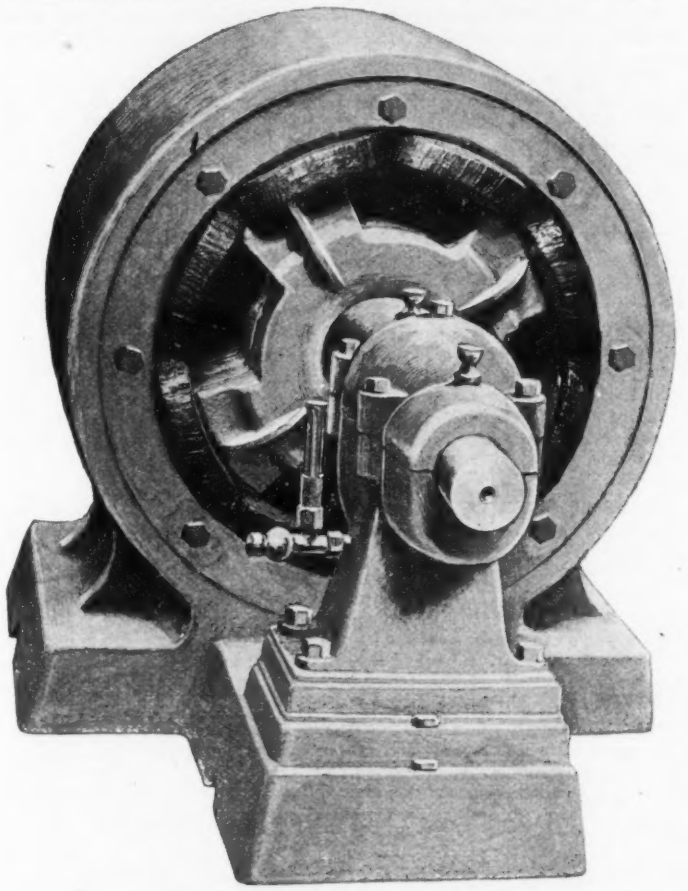


FIG. 1.—OPEN END OF ALTERNATOR.

that will not burn out or require costly repairs, and which may be put into most severe service and left to run indefinitely without attention of any sort. The makers claim that the excitation required amounts to only one

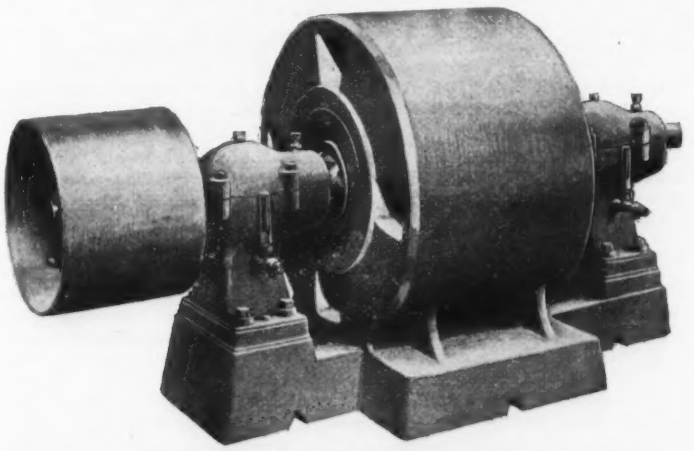


FIG. 2.—CLOSED END OF ALTERNATOR.

half of one per cent. of the capacity of the machines, and they will insure the apparatus against burn-outs other than lightning discharges, at one half of one per cent. on a fixed price per annum.

The machine is shown complete in Figs. 1 and 2, the armature ring in Fig. 3, the armature and exciting coils in Fig. 4, and the inductor or rotating magnetic core in Fig. 5.

The armature consists of a stationary removable laminated ring, which

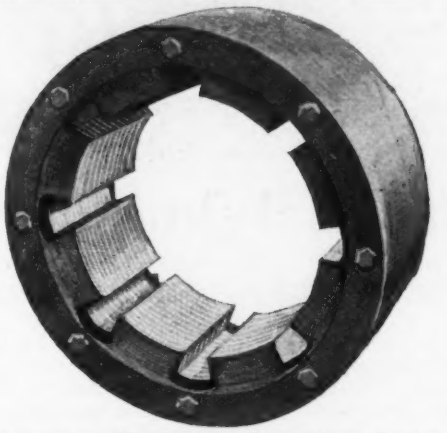


FIG. 3.—STATIONARY, REMOVABLE LAMINATED ARMATURE RING.

fits accurately into a bell-shaped steel frame. The single exciting coil, shown in Fig 4, is attached to this steel frame. The revolving part or inductor consists of a cast-steel cylinder, on which are pressed laminæ, which form the rotating poles; it fits into the ring closely, the air gap being extremely small. The armature coils, as shown in Fig. 4, are wound on forms and can easily be replaced in case of an injury from lightning discharge or accident.

The mechanical features have received careful consideration. The exceptionally long self-aligning and self-oiling bearings, carrying a forged

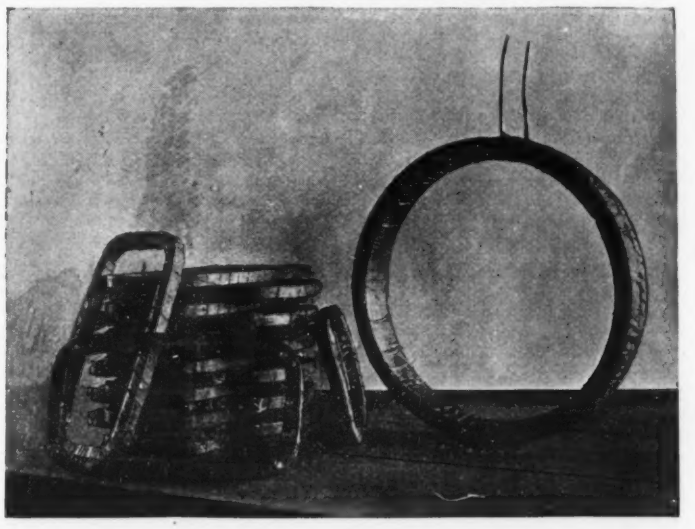


FIG. 4.—ARMATURE COILS AND EXCITING COIL.

steel shaft of great diameter, permit running the inductor at the least possible clearance from the stationary parts, thereby reducing to a minimum the reluctance due to air gap.

The construction of the machine is such as to permit of various ways of connecting for different voltages without in any manner changing the machine or requiring new coils. It may be connected for a 110 or 220 volt system, and used without transformers for short distances, or for 1,000 or 2,000 volts to be used with transformers for long-distance transmission; or it may be connected to operate a 110-volt circuit and a 1,000-volt circuit both at the same time. The machine operates without collector rings, brushes or revolving contacts of any kind.

The 40 and 60 kw machines will be built as shown in the accom-

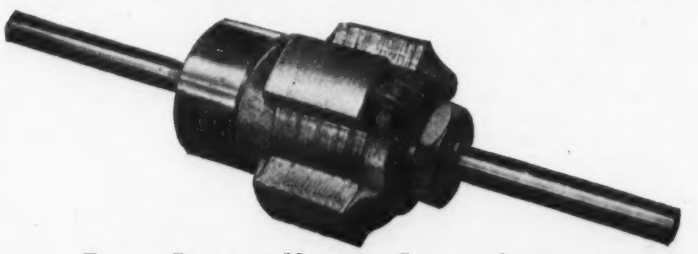


FIG. 5.—ROTATING MAGNETIC CORE, OR INDUCTOR.

panying illustrations, the frame being cast of steel in one piece. In larger sizes the upper half will be cast separate and bolted to the lower half in the usual manner.

NEWS OF THE WEEK

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, Sept. 7, 1895.

THE ELECTRICAL STOCK LIST displayed no particular activity this week, about the only trading being in General Electric and the three leading tractions of Philadelphia, and that not extensive. General Electric, Westinghouse and Electric Storage closed somewhat higher than last week, but the advance does not appear to be based upon any sustaining conditions, and General Electric showed signs of reaction immediately preceding the close.

LONG ISLAND TRACTION is showing the effects of the recent reorganization. Prior to the promulgation of the scheme the stock was sluggish around 9 and 10; this week it closes at figures over 100 per cent. better than the ante-reorganization prices.

	Par.	Bid.	Asked.
ELECTRICAL STOCKS.			
Chicago Edison Company	100	120	125
Edison Electric Ill., New York	100	98	100
" " " Brooklyn	100	110	115
" " " Boston	100	150	..
" " " Philadelphia	100	..	115
Edison Ore Milling	100	13	15
Electric Storage Co., Philadelphia	100	46	..
General Electric	100	39½	40⅛
General Electric, pref	100	69	71
Westinghouse Consolidated, com	50	36½	37
" " pref	50	54	55
BONDS.			
Edison Electric Ill., New York	105	105½	105½
Edison Electric Light of Europe	100	75	85
General Electric Co., deb. 5s	100	..	90¼
TELEGRAPH AND TELEPHONE.			
American Bell Telephone	100	198	199
American District Telegraph	100	30	40
American Telegraph & Cable	100	96	100
Central & South American Telegraph	100	117	120
Commercial Cables	100	150	..
†Erie Telephone	100	62	63
Gold & Stock Telegraph	100	105	..
New England Telephone	100	88	90
New York & New Jersey Telephone	100	103	105
Postal Telegraph-Cable	100	63½	..
Western Union Telegraph	100	94	94⅛
ELECTRIC TRACTION STOCKS.			
Baltimore Traction	25	20	..
Binghamton RR. com	100	100	..
Brooklyn Traction	100	15	18½
" " pref	100	..	53
Buffalo St. Ry	100	88	91
Cleveland City Ry	100	69	70
Cleveland Electric Ry	100	59	60
Columbus St. Ry	100	48½	..
Consolidated Traction of N. J	..	25	..
Electric Traction, Philadelphia	50	74	75
Hestonville	100	58	..
Long Island Traction, 1st in pd	100	21	21¾
Louisville St. Ry. com	100	37	39
" " " pref	100	87	88
New Orleans Traction	100	24	27
" " pref	100	79	81
North Shore Traction	100	34½	36
" " pref	100	84	88
People's Traction $30 pd	25	66¾	67
Philadelphia Traction	50	84¾	85
Rochester St. Ry	..	38	..
Union Ry. (Huckleberry)	100	112	115
West End, Boston	100	78	78¾
" " pref	100	92	92½
Worcester Traction	100	18	20
" " pref	100	86	90
BONDS.			
Buffalo St. Ry. 1st con. 5s	100	106	109
*Binghamton Railway Co. 5s	100	99	100
*Columbus St. Ry. 1st 5s	100	104	..
Rochester St. Ry. 1st 5s	100	95	97
*Union Ry. 1st mtge 6s	100	105	108
*Westchester Electric 1st mtge 5s	100	98	101

* With accrued interest.
† Ex-Div.

Special Correspondence.

NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
253 Broadway, NEW YORK, Sept. 9, 1895.

MR. H. C. HOPE, superintendent of telegraph and signals for the Northwestern Line, and located at St. Paul, Minn., was a visitor in New York last week.

THE ELECTRICAL MAINTENANCE COMPANY, 50 Broadway, New York, has opened a branch office at 1111 Betz Building, Philadelphia, Pa., with Mr. J. W. Cregar in charge.

THE SEA BEACH DISASTER.—The wreck on the Sea Beach Railway on Labor Day brought out the fact that the road has no telegraphic nor telephonic means of communication along its line, the only system of signaling being by means of flags.

THE AMERICAN TELEPHONE & TELEGRAPH COMPANY gave a public reception on last Friday afternoon at the Board of Trade on the occasion of the opening of its long-distance lines connecting Louisville with the principal cities of the East and West.

HUEBEL & MANGER, of Brooklyn, find business satisfactorily increasing, and the number of orders now being received foreshadow a very prosperous Fall trade. They say that the sources of their orders indicate that the business revival is general throughout the country.

THE CHIEF TROLLEY INSPECTOR of Brooklyn has reported 104 violations during the month of August of the trolley speed ordinance. The highest rate of speed was on the Fulton Street line of the Brooklyn Heights Company, one car on Aug. 17 having attained a speed of 23 miles an hour.

COL. S. E. A. STEVENS, president of the Hoboken Warehouse & Steam Connecting Railway Company, has made application to the Hoboken Common Council, for permission to build an electric railway along the river front, to afford direct connections with the steamship docks and the railways.

PRESIDENT HART, of the Long Island Electric Railway Company, has presented a petition to the Highway Commissioners of the town of Jamaica, for permission to erect a steel and stone bridge at the Liberty Avenue crossing at Ozone Park. Mr. Hart has stated that as soon as this permission was granted, the contractors were all ready to go ahead and build the road throughout its entire length.

THE WESTERN ELECTRIC COMPANY last week obtained a decree in Baltimore against the Viaduct Manufacturing Company, of that city, for infringing its patents for telephone switches. Damages for infringement in the amount of $300 were awarded, the cost of the suit to be paid by the defendant, which is perpetually enjoined. The decree was signed by consent of all the parties to the controversy.

THE BOUDREAUX DYNAMO BRUSH COMPANY reports very nice business from the Pacific Coast where Agent J. W. Brooks has been busy introducing it to the trade. He says the people like it immensely. The Barden-Sheets Electrical Construction Company, of Houston, Texas, has taken the agency of the brush for Arkansas, Texas, Indian Territory and New Mexico after having found a large demand for it in their own State.

NEW ENGLAND NOTES.

Branch Office of THE ELECTRICAL WORLD,
Room 91, Hathaway Building, 620 Atlantic Ave.,
BOSTON, MASS., Sept. 7, 1895.

THE WADDELL-ENTZ COMPANY.—Notice has been given that on Sept. 30, 1895, at 11 a. m., there will be sold at public auction the various effects of the Waddell-Entz Company, at Bridgeport, Conn.

MR. PHILIP M. REYNOLDS, treasurer of the Anchor Electric Company, has returned from his European trip after an absence of just six weeks, looking as brown as a berry, and says that throughout he enjoyed the trip immensely.

THE RUSSELL ELECTRIC MANUFACTURING COMPANY, Providence, R. I., is now installing 500 mast arms for the Narragansett Electric Lighting Company, of Providence. This makes a total of 1,850 Russell mast arms in use within the city limits of Providence, R. I. The present installation embodies many new ideas of Mr. Russell's invention.

THE MAGNETIC CLUB has announced the following officers for 1895: President, Edward C. Cockey; vice-presidents, W. H. Baker, John Brant, T. E. Fleming, George H. Usher; secretary, George F. Fagan; treasurer, W. C. Burton; governing committee, T. A. Brooks, J. F. Shorey, John Riley, M. H. Kerner, M. W. Rayens, D. W. McAneeny, Reuben Fagan, T. G. Singleton.

MR. A. ARTHUR ZEIGLER, president of the Zeigler Electric Company, entertained during Knights' Templar week, in his charming home at Jamaica Plain, quite a number of electrical visitors, friends of his, among whom were Mr. W. T. Osborn, of W. T. Osborn & Co., Kansas City, Mo., and Mr. J. F. Scheffler, a former resident of Boston, but now connected with the General Electric Company, at Chicago.

THE HOLLY STEAM ENGINEERING COMPANY, of Providence, R. I., has recently booked the following contracts for installations of the Holly gravity return system: Portland (Me.) Street Railway Company's power station; Holyoke (Mass.) Street Railway Company's power station; Builders' Iron Foundry, Providence, R. I.; Corliss Steam Engine Company, Providence; Brown & Sharpe Manufacturing Company, Providence (second installation); The Phelps Publishing Company, Springfield, Mass.; Twenty-fifth Street Power Station Metropolitan Traction Company, New York City, and Fall River Bleachery, Fall River, Mass.

THE COLUMBIA ELECTRIC COMPANY, of Worcester, Mass., has been doing an excellent business in the line of new installations, the following being among its more recent contracts: A combined arc and incandescent electric lighting plant for the American Wheelock Engine Company, for its new works at Worcester, the contract for which was awarded to the Columbia Company after the consideration of the claims of some of the most prominent companies in the country; an electric lighting plant in the factory of J. W. Bishop & Co., contractors, of Worcester, furnishing the dynamo and installation work; an addition to the plant of the Gilbert Loom Works, and a contract for the electrical work for the new building in Worcester, to be occupied as a home for aged women.

WESTERN NOTES.

Branch Office of THE ELECTRICAL WORLD,
936 Monadnock Building,
CHICAGO, Ill., Sept. 6, 1895.

MR. GEORGE S. STITCH, vice-president of the Western Telephone Company, is off for a ten-day trip through Iowa.

MR. J. G. PARMLEE, Springer Building, has bought out Mr. James McLean's interest in the McLean Armature Works.

THE McGUIRE MANUFACTURING COMPANY is increasing the capacity of its factory, and also constructing a handsome brownstone office.

THE NATIONAL ASSOCIATION OF MANUFACTURERS OF THE UNITED STATES OF AMERICA has postponed its annual convention at Chicago to Nov. 19, 1895.

MR. CHARLES E. GREGORY, president of the Chas. E. Gregory Company, has purchased a bicycle, and is now spending his evenings in breaking the records of south side "scorchers."

MR. A. SHILLINGLAW, manager of the Bradford Belting Company, is jubilant over the large trade in Bradford lamps and batteries, as well as in the increase of the general business of the firm.

THE C. E. WOODS COMPANY, owing to its rapidly increasing business, has been compelled to seek larger office accommodations, and is now moving to 1315 and 1316 Monadnock Building.

COL. J. W. SHAY, of the Munson Belting Company, has just returned to Chicago after making an extensive and successful trip as far west as California. He reports that the business outlook for the coming season in that section of the country is very encouraging.

MR. A. G. WELLINGTON, of the Griffin Wheel & Foundry Company, Western Union Building, has just returned from his vacation. Mr. Wellington's company has just increased its capacity one third by building an addition to its Chicago factory, and expects to put its Denver factory in operation this month.

THE CHICAGO OFFICE of the Electric Storage Battery Company has sold a battery of Chloride accumulators for use on the new private car of President Fish, of the Illinois Central Railway Company. This car will be one of the finest ever turned out of the Pullman shops, and the Chloride accumulator was selected by reason of its past record in the service of the Illinois Central Company.

THE SIEMENS & HALSKE COMPANY, it is perhaps not generally known, is also a builder of steam locomotives, and recently completed the first of 20 locomotives for the C., B. & Q. Railway. The workshop equipment which enables it to turn out steam locomotives will doubtless before long prove very useful, as the development of high power electric traction makes its demands felt.

THE WESTERN TELEPHONE CONSTRUCTION COMPANY has just received a contract from the Effingham Telephone Company, of Effingham, Ill., for a 100-telephone exchange. It has also furnished the Columbus Memorial Building with a private exchange, with switchboard mounted on an oak table, the telephones being of the portable type, nickel-plated. A shipment of telephones has also just been made to Yokohama, Japan, and another to Mexico.

THE FIRM OF FISHER & PORTER will be dissolved by mutual consent on Sept. 30, 1895. Mr. Albert Fisher will retain the present office, Room 1025, Monadnock Block, and will represent Wm. Todd & Co., of Youngstown, Ohio, on their high grade and heavy duty engines, rolling mill and blast furnace machinery. Mr. H. F. J. Porter will retain the agency of the Bethlehem Iron Company, and will move to Room 1433, Marquette Building. These changes will occur Oct. 1, 1895.

MR. GEO. A. McKINLOCK, president of the Central Electric Company, who has been spending a brief vacation in the East, was in New York last week and started on his return trip Tuesday evening. Mr. McKinlock expresses himself as well satisfied with the results achieved by his company this Summer and predicts that this Fall will witness a revival of oldtime Western push and prosperity. Chicago and the West have, in Mr. McKinlock, both a worthy representative and a most enthusiastic champion.

THE D. A. KUSEL TELEPHONE MANUFACTURING COMPANY, 22 North Second Street, St. Louis, is meeting much success with its new telephone apparatus. Mr. D. A. Kusel, inventor of the remarkably efficient transmitter manufactured by this firm, is one of the oldest electricians in the country, having been connected with the electrical manufacturing business for over 25 years. Mr. James S. Cuming, the business manager of the company, though a young man, has had a wide experience as a commercial salesman in other lines, and will hereafter devote his entire attention to the business of the above mentioned firm, in which he has purchased a half interest.

THE CHICAGO BOARD OF TRADE is now tearing out its entire electrical, steam and hydraulic plant installed some years ago, and installing a new one, consisting of five high-pressure horizontal tubular boilers, two 125-hp Ames compound engines, two 75-kw Westinghouse direct-connected generators, six 10-hp Westinghouse multipolar motors for operating ventilating fans, four Sprague electric elevators, in place of the present hydraulic ones, and 60 1,600-ampere-hour Pumpelly-Sorley storage batteries to be used in conjunction with the elevators. The building is being rewired throughout for a capacity of 100 amperes on each of the nine floors, and the switchboard so arranged that all the elevators, motors and different lighting circuits of the building are handed directly from the board. Weston instruments are being used throughout, and other late devices of all kinds. It is expected that the new plant will largely decrease the coal bill. Mr. B. J. Arnold is consulting electrical engineer of this building.

ENGLISH NOTES.

[FROM OUR OWN CORRESPONDENT.]

LONDON, Aug. 28, 1895.

BRITISH MUSEUM.—A considerable extension of the electric lighting of the large reading room at the British Museum is now in hand.

ELECTRIC TRAMWAY FATALITY.—An accident has occurred on the tramway running from Port Rush to Giants' Causeway. A cyclist endeavored to run his machine on to the line, but ended in being thrown off and pitched on to the bare conductor with his bicycle on the top of him, one end touching the rolling rails and the other the positive lead. The unfortunate cyclist was immediately removed, but despite the efforts of two doctors expired shortly afterward.

THE EVERSHED SYSTEM OF ELECTRIC COMMUNICATION WITH LIGHTSHIPS.—In addition to the "discontinuous" cable system, which has so far succeeded at the Fastnet lighthouse, an experiment is shortly to be made with an inductive system, in connection with a lightship on the Goodwin Sands. This plan is due to Mr. Sydney Evershed and consists in taking a circle of wire at the bottom of the sea, round the lightship and sending interrupted currents through this circuit. The lightship itself is wrapped round with a low-resistance secondary, in the circuit in which there is a telephone.

MUNICIPAL SALARIES.—Our municipalities appear to be waking up to the short-sightedness of paying such low salaries to their municipal electric lighting engineers as has been their custom hitherto. In consequence of their low pay, these engineers are constantly on the move to obtain small rises. The Hull corporation, whose central station has not been in operation two years, has already parted in this way with two engineers and is now seeking for a third. As the Hull corporation throws an immense amount of responsible work in the matter of drawing up plans and specifications for extensions of plant, the settlement of tenders, and the supervision of new work upon its engineer, it finds itself at the present moment in a somewhat awkward fix, owing to this gentleman suddenly resigning at a moment when extensive and expensive extensions to the municipal station are under way.

BRITISH ASSOCIATION.—The committee of Section G, the mechanical engineering section, of the British Association meeting at Ipswich, have just issued a preliminary list of the papers which will be read in that section. The work to be attempted appears both voluminous and diversified and includes a considerable number of electrically interesting papers. Whether or not these will be of the usual British Association type remains to be seen. Mr. Preece will read a paper on "Induction Telegraphy" and another on "Glow Lamps." Mr. A. R. Bennett is going to give up his views on telephony and Mr. Trotter, in conjunction with Mr. Preece, will read a paper on "A New Portable Photometer." Two interesting discussions are impending, one of these, on B. A. standard screws, will be opened by Mr. R. E. B. Crompton in Section G; the other on the vexed question of magnetic units, seems likely to occupy a considerable portion of the time of Section A.

RAILWAY COMPANIES AS ELECTRICAL MANUFACTURERS.—The amalgamation of the Baldwin Locomotive Works, of Philadelphia, with the Westinghouse Company, so far as electric traction work is concerned, has attracted some little attention on this side of the water. It is not very likely that anything of the kind will take place here. The majority of our large railway companies possess extensive shops from which they turn out all the heavy apparatus which they require, and not only so, but manufacture for sale to smaller railways and such like. Should our railways adopt electric traction either for trunk lines or branch lines, it is not very probable that they will seek the assistance of one or other of our big electrical manufacturing concerns, such as the Brush Company or the Electric Construction Company. I is possible, indeed, that they might, under such circumstances, become not coadjutors but competitors with the ordinary electrical manufacturing concerns.

SOUTH STAFFORDSHIRE TRAMWAYS COMPANY.—The South Staffordshire Tramways Company which, under the auspices of Mr. Alfred Dickenson, inaugurated the side-trolley system, has of late been amidst the breakers, having been in the hands of a receiver and engaged in litigation with the Electric Construction Company, who have a contract for running the electric cars. The new board is, however, apparently doing its best to pull the company round and to save it from the hands of those who, it would seem, wish to wreck it. An instance of the way in which the company was converted into a source of profit for contractors of various kinds is the contract which was entered into with the Electric Construction Company in 1892, a contract which the new chairman stated at the meeting of the shareholders on Monday meant "absolute ruin" to the concern. The agreement signed by the former directors of the company provided for the payment of 9d. per car mile. Now the working expenses payable by the company amounted roughly to 2½d. per car mile, making a total outlay of 11½d. The receipts are roughly 10d., so that there is under the contract an actual loss of 1½d. per car mile, or £1,500 per year.

General News.

TELEGRAPH AND TELEPHONE.

ASHLAND, WIS.—A new telephone company has applied for a franchise.

COLFAX, IA.—C. C. Davis, the electrical engineer of the Colfax Electric Light power house, is figuring to put in a telephone exchange for Colfax.

MT. CARROLL, ILL.—Henry Lambert, representing the Keystone Telephone Company, of Pittsburg, Pa., has been in town with a view to establishing a telephone system here.

HARMONY GROVE, GA.—W. B. Hardman, L. G. Hardman, T. C. Hardman, and W. D. Thurmond have applied for a charter for a telephone line from Harmony Grove to Athens.

MENASHA, WIS.—At the meeting of the Menasha City Council, the Wisconsin Telephone Company was granted a franchise to erect and maintain telephone exchanges in the city.

DECORAH, IA.—The citizens are making efforts to establish a telephone exchange in Decorah. Mr. Van Rolf, the district superintendent of the Iowa Union Company, and Mr. Rosenthal, the local manager, are interested.

BUTTE, MONT.—A franchise was granted some months ago by the Butte Council to the Mutual Telephone Company, and preparations are now on foot to get the company started. The capital stock of the new company is $200,000.

COLORADO SPRINGS, COL.—The Automatic Telephone Company, which has been organized with a capital stock of $200,000, has acquired the State right of the Strowager telephone and proposes to make Colorado Springs its headquarters.

KENT, O.—The Kent telephone exchange was opened to the public on Sept. 1, using the American Electric Telephone Company's Hunnings instruments. The patrons of the exchange are reported to be very highly pleased with the service and the instruments.

LA GRANGE, ORE.—W. D. Fletcher, of Pendleton, has been in this city in relation to the proposed telephone line to connect La Grange, Union and Elgin. The plan is to organize a stock company. F. B. McCully is interested in a telephone line to Wallowa County.

CLEVELAND, O.—It is proposed to organize an automatic telephone company. A conference was recently held in the office of Mr. James H. Hoyt, at which it was announced by Col. Fogg that the offers of aid already secured assures the establishment of the new system in Cleveland.

DETROIT, MICH.—The Harrison Telephone Company will file its acceptance of its franchise with the city and complete its plant within the period prescribed by the ordinance. The company's directors met and elected officers as follows: President, Albert Peck; vice-president, Charles Flowers; treasurer, Collins B. Hubbard; secretary, W. L. Holmes. R. A. Brett will act as manager of the company.

ELECTRIC LIGHT AND POWER.

ALEXANDRIA BAY, N. Y.—An electric light plant will be put in at Central Park this fall.

CHICOPEE, MASS.—Excavations have been commenced for the foundation of a new electric light plant.

BETHEL, VT.—A stock company has been formed to own and operate an electric light plant in Bethel.

YOUNGSTOWN, O.—H. F. Kearcher has applied for a franchise to construct and operate an electric plant.

LA HARPE, ILL.—The Electric Light Company has purchased a new site and commenced work on a power building.

SHREVEPORT, LA.—A. B. Newman desires prices of machinery, material, etc., for a municipal electric lighting plant.

LIVINGSTON, MONT.—The Livingston Water Works & Electric Light Company are arranging to enlarge their plant.

AHNAPEE, WIS.—Joseph Wodscalek's electric light plant has been destroyed by fire. The loss is $15,000, and insurance $10,000.

DEADWOODS, S. D.—The Electric Light Company is making arrangements to replace a 750-light alternating machine in its plant.

PALOUSE, WASH.—Local business men are making arrangements to put in a 600-light electric plant, to be operated by water power.

GOLDSBORO, N. C.—Henry Lee will receive bids for an electric light plant, to consist of one 500-light generating machine, lamps, etc.

LEICESTER, MASS.—Thomas S. Livermore will erect a building, 38x86, which will contain all modern conveniences, such as electric lights, etc.

SHENANDOAH, PA.—New and improved machinery will be introduced in the power house of the Schuylkill Traction Company at Rappahannock.

UNION CITY, MICH.—Rheubotton & Bonds have been granted a 15-year franchise for an electric light plant, and expect to commence its construction soon.

LAKE CITY, IA.—E. G. Flynn, of Lake City, has secured the franchise for an electric light and pumping plant. L. D. Merriam, of DeKalb, has prepared plans for same.

SAGINAW, MICH.—The matter of conduits and the placing of electric, telephone and telegraph and other wires underground is being agitated by the Saginaw officials.

SHELBYVILLE, O.—The Council has decided to rebuild the electric light plant, to purchase a new dynamo and boiler, and otherwise improve and increase the plant.

BLOOMFIELD, N. J.—Paul W. Schroeder, of New York City, has applied by letter to the Bloomfield Township Committee for a franchise for lighting the town with electricity.

LANCASTER, PA.—The Edison Electric Light Company will build an annex, 40 x 100, to its plant at Engleside, to cost $10,000. Herman Wohlsen has the contract for the building.

BAY CITY, MICH.—The electric light commission at a meeting appointed a committee to advertise for bids for supplying the Bay City electric light plant with new dynamos and other apparatus.

MARQUETTE, MICH.—At a meeting of the Common Council a resolution was adopted appropriating money to be expended for the improvement of the city's electric light plant. Thomas Meads is recorder.

THE DELEVAN LIGHT & FUEL COMPANY, Delevan, Wis., has decided to install, this fall, a central station plant for electric lighting. Pierce & Richardson are the consulting and designing engineers for the plant.

SPRINGFIELD, MO.—A movement is in progress to have an electric light tower built in the centre of the square. Councilman W. H. Gottfried has the matter in charge. It is proposed to build a steel tower 80 feet in height, and have four arc lights placed thereon.

THE ELECTRIC RAILWAY.

VENICE, ILL.—An extension of the Venice, Madison & Granite City electric railway will be made.

SANTIAGO, CAL.—George B. Kerper, owner of the Santiago Cable Railway, will change the motive power to electricity.

CATAWISSA, PA.—The North Susquehanna Transit Company has applied for street privileges for a new electric railway.

LITTLE ROCK, ARK.—The Healey Street Railway Company has been granted a franchise to extend its electric road.

DULUTH, MINN.—J. C. Seeley, of Brainerd, is interested in the proposed electric railway across the Crane Lake portage.

BRADFORD, PA.—An ordinance repealing the franchise of the Bradford & Mendall Street Railway has been finally passed.

TROY, N. Y.—Another extension of the Troy City Railway will soon be made. The new branch will be on Oakwood Avenue.

KIRKSVILLE, MO.—S. M. Pickler and T. J. Dockey are endeavoring to secure a franchise to build an electric railway in Kirkville.

RICHMOND, VA.—The ordinance granting the Broad Street franchise to the Traction Company has been signed by Mayor Taylor.

FREDERICK, MD.—The directors of the Frederick & Middletown Electric Railway, have decided to soon begin the construction of the road.

FAIRFIELD, KY.—James McKenna has been appointed treasurer of the organization promoting an electric line from Louisville to Fairfield.

LOS ANGELES, CAL.—Proposals are wanted until Sept. 24 for the purchase of a franchise for an electric railway. T. E. Newlin is county clerk.

McKEESPORT, PA.—An ordinance giving the McKeesport & Portvue Railway Company right over certain private streets has been recommended.

DETROIT, MICH.—The Citizens' Company has made application for permission to transform the Bush & Russell streets car line into an electric road.

DETROIT, MICH.—Col. Seymour Brownell, of Detroit, and others are interested in the construction of an electric railway between Detroit and Pontiac.

SHREWSBURY, N. J.—The township committee of Shrewsbury has granted a franchise to the trolley company to build tracks from Eatontown to Red Bank

MIDDLETOWN, N. Y.—The Traction Company having received its franchise for Bonnell and Stanton Streets, will commence work on the asylum extension at once.

ST. CLAIR, MICH.—Lester B. French, the real estate dealer in Detroit, and Ex-Congressman W. C. Maybury are interested in the project to construct an electric railway from Detroit to Port Huron.

BALTIMORE, MD.—A survey of the whole route of the Washington, Sandy Springs & Baltimore electric railway has been completed. Dr. Frank C. Drane is general manager of the company.

ST. CLAIR, MICH.—There is a project to build an electric road from Detroit to Port Huron. The estimated cost of the entire 65 miles of road, including power stations and all equipment, is $500,000.

CLARKSVILLE, TENN.—Books have been opened for subscriptions to the stock of a company to build an electric railway system in Clarksville. The cost of the plant proper has been placed at $40,000.

HACKENSACK, N. J.—The effort of the Bergen Traction Company to build a trolley line to Hackensack is meeting with opposition, but the corporation declares it will accomplish what it has undertaken.

CLEVELAND, O.—An interurban street railway between South Brooklyn, a suburb of Cleveland, and Akron, O., to be operated by electricity, will soon be built. N. W. Baird, 901 Garfield Building, is interested.

POTTSVILLE, PA.—Dallas Sanders, president of the Schuylkill Traction Company, has decided against the construction of an electric railway from Shenandoah to Ringtown, because of the great expense entailed.

PETERSBURG, VA.—The Board of Supervisors of Chesterfield County has awarded the right of way to run an electric line from Manchester to Petersburg to a company represented by John Robertson, of Manchester.

JAMESTOWN, N. Y.—City Clerk Barker has received a letter from J. A. Lowery, of Utica, asking if there was room in Jamestown for another line of street cars. Mr. Lowery wants to put in two miles of track this season.

SYRACUSE, N. Y.—It is claimed that the Syracuse & Suburban Railway Company have secured the necessary number of consents to build a railway through Fayette Street to the city line. Ex-Mayor Wm. Cowie is interested.

LONG BRANCH, N. J.—Application has been made to the Long Branch Commissioners by the Atlantic Coast Electric Railway Company for the location of its tracks within the corporate limits of Long Branch. R. Blodgett is president.

DETROIT, MICH.—The Township Board of Crosse Point, a suburb of Detroit, has granted to the Detroit Suburban Railway Company, 12 Woodward Avenue, Detroit, a franchise for 30 years to construct, equip and operate an electric railway.

ORCHARD LAKE, MICH.—Col. J. Summer Rogers and others have secured the necessary franchises and right of way of an electric railway to connect Orchard Lake with lines in Detroit. Col. J. Summer Rogers, Michigan Military Academy, Orchard Lake, is interested.

BALTIMORE, MD.—The county commissioners gave a hearing Sept. 4 on the application of the South Baltimore Company for electric railway privileges in the Thirteenth District. The company desires to build an electric railway from its property to Meeter's Pavilion.

MAYS LANDING, N. J.—The Camden & Atlantic Railway Company has decided to double-track the entire road, which runs from Camden to Atlantic City, a distance of 60 miles. Work will be begun at once. The question of equipping the road with electricity was discussed, but was not finally decided.

RICHFIELD SPRINGS, N. Y.—At the meeting called by the trustees of the village, Aug. 29, for the purpose of obtaining the opinion of the property owners regarding the granting of a right to permit the building and operating of an electric road through several streets, the general voice was against the project.

VALLEY FALLS, R. I.—The Cumberland Town Council has given permission to the Woonsocket Street Railway Company to build and operate an electric railway, from the Woonsocket line, on the Woonsocket & Cumberland Hill road, via Cumberland Hill, to the Lincoln town line at Manville Bridge. The president of the company is E. K. Ray.

FLORENCE, NEB.—It has been decided by the Council that the municipality will hold a special election Sept. 17 to vote on the proposition of granting a bonus of $13,000 to the Omaha & Florence Street Railway Company, to aid in the construction of an electric railway from Ames Avenue to Florence. V. G. Lantry, Walter G. Clark and Fred. Parker are interested.

ST. HELENA, CAL.—The town trustees have granted L. Crothwell a franchise to build an electric road along the main streets of St. Helena, and to construct and operate an electric light plant. Mr. Crothwell already has franchises from the county supervisors and the Napa City trustees, and proposes soon to begin work on the electric road from Napa to Calistoga.

MEADVILLE, PA.—President S. B. Dick, of the Pittsburg, Shenango & Lake Erie Railway Company, is discussing the introduction of electricity as a motive power for passenger and freight trains. The plan is to erect an extensive plant in connection with the Phœnix Iron Works at Meadville, and operate at the start out, 15 miles of track between Meadville and Meadville Junction by electricity.

Trade and Industrial Notes.

THE DAVIS-FARRAR COMPANY, Erie, Pa., closed a contract on Sept. 5 with the Apollo Iron & Steel Company for what will be the largest electric pumping plant in the world, the capacity to be 40,000,000 gallons every 24 hours.

THE FOSTER ENGINEERING COMPANY, of Newark, N. J., recently equipped 15 locomotives of the Lehigh Valley Railway with its inside safety boiler checks, and have just received an additional order from the same for 30 more of the checks. U. S. Gunboats Nos. 7, 8 and 9, under construction at Newport News, will be equipped throughout with Foster pressure regulators and reducing valves.

ACETYLENE GAS.—In a recent circular issued by the Pennsylvania Acetylene Gas Company, 421 Chestnut Street, Philadelphia, Pa., much interesting information is given in regard to this product, which is now exciting so much attention. The history of the accidental discovery by Mr. Wilson, of the electrical process of making the gas, is related, and a number of extracts from various scientific articles are included in the circular.

THE GOULDS MANUFACTURING COMPANY, Seneca Falls, N. Y., in its recent orders finds evidence of the improved business situation, not only in the number of orders received, but in their distribution. In a recent list we thus find sales credited to such widely separated sections of Maine, Georgia and Colorado. As an indication of the world-wide reputation of the Goulds pump it may be noted that Nova Scotia and Japan are represented on the list.

"COLOR YOUR OWN LAMPS."—Under this title the Webster Company, 400 Liberty Street, St. Paul, Minn., has issued a circular calling attention to its process for coloring incandescent lamps. This consists merely in the immersion of the lamp in a bath made from a solution of coloring matter prepared by the Webster Company, the process being simple and practically instantaneous. A number of different colors are made, and also ground glass and opal preparations.

TRANSFORMERS AND LIGHTNING.—In a recent letter received by the Electrical Appliance Company, of Chicago, a customer states that during a recent severe storm no less than eight transformers of almost as many different makes were completely burned out by lightning, while not one of quite a large number of the Packard transformers was injured. This he considers a strong substantiation of the claim of the manufacturers that the design and construction of the Packer transformer is such as to render it practically impossible to burn it out.

THE DIAMOND MACHINE COMPANY, of Providence, R. I., will soon place on the market several special grinding machines, one of which will be of large size for grinding cutters and reamers of unusual shape or dimensions. This company has developed a large business in the manufacture of special machinery for bicycle manufacturers, which, in view of the extremely rigid requirements for bicycle work, speaks well for the efficiency of their machines. The company intends also to manufacture bicycles on its own account, as during the last year.

THE PROCTOR-RAYMOND ELECTRIC COMPANY, of Rochester, N. Y., has removed its business to 442 Niagara Street, Buffalo, seven carloads of machinery and supplies for the manufacture of electric bells, annunciators, house goods, etc., having been received at its works in the latter city last week. Mr. Charles M. Proctor says that with his present equipment he will be able to make 1,000 bells a day, and expects to increase the capacity of the factory from time to time. At first he will employ 50 hands, which number will be gradually increased. The associate of Mr. Proctor is Mr. Nelson H. Raymond, who has devised many of the novelties made by this concern. Business is expected to begin about Sept. 1.

STORAGE BATTERIES.—The Electric Storage Battery Company, of Philadelphia, has recently closed two contracts for storage battery plants, the character of which indicates the diversity of applications of which the storage battery is capable. One of the plants is for a dry goods store in St. Louis, and consists of 58 F-11 chloride cells, having a capacity of about 100 16-cp lamps, and will be used for a night lighting service, required by the sweepers and watchmen after the dynamo has been shut down. Another plant is for the Anaconda copper mines, consisting of 270 500-ampere-hour cells, for regulating the load on the generators operating the trolley road used for hauling material from the mines. The battery will also be employed for lighting during two or three months of the year, for which work it will be charged from the railway circuit and discharged in five series in multiple.

A NEW INCANDESCENT LIGHT COMPANY.—An indication of the improved business situation is afforded in the announcement of a new incandescent lamp manufacturing enterprise which has been incorporated as the International Electric Company, and will be located in St. Louis. The business management is in the hands of Mr. H. G. Ferguson, who has been actively identified with several large central stations in the West and is thoroughly familiar with electrical matters, both theoretically and practically. The factory, which is located at Nineteenth and Olive Streets, is in charge of Mr. J. M Davey, who for some years has been identified with the incandescent lamp business, and is a recognized expert in the manufacture of lamps. The new lamp, which will be put upon the market very shortly, will be known as the "Davey High Grade," and as it will embody among other improvements the results of recent experiments of a chemical nature, it is confidently expected to take a high rank from the start.

TURRET DRILLS.—The manner in which machine tools are becoming specialized is exemplified in the catalogue of the A. D. Quint Company, which firm manufactures only turret drills. This form of drill has not been long in general use, and in many respects it is a valuable workshop addition. One form of drill described in the catalogue is made with from two to 12 spindles; it is designed to drill, ream, counter-bore and tap general machine shop work without the loss of time to change tools and move the piece operated upon, as in the case of the common drills. The advantages of this arrangement are apparent and may be enumerated as follows: All tools drill to the same point in the centre of the table, thus insuring accurate work, drilling and tapping at the same operation; only the spindle in use revolves, thus saving much wear of spindles, bearings and beltings. The form is compact, thus making a cheap machine for its capacity; and last, but not least, the saving of operator's time in changing tools and moving work is very large.

Business Notices.

ELECTRIC LEAGUE.—Meets every Thursday evening, 100 West 24th Street, New York. Electrical engineers and electricians cordially invited.

BATTERY CUT-OUT CHEAP.—Sensitive, reliable, never requires attention. Gas lighting much improved by its use. Electric Supply Company, of 15 South Warren Street, Syracuse, N. Y.

Illustrated Record of Electrical Patents.

UNITED STATES PATENTS ISSUED SEPT. 3, 1895.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

545,469. ELECTRICAL SIGNALING APPARATUS; J. H. Filden, Chicago, Ill. App. filed June 12, 1895. The combination of a lever adapted to be actuated by a passing train, a contact lever, a swinging contact having an insulated section with which the lever contact normally engages.

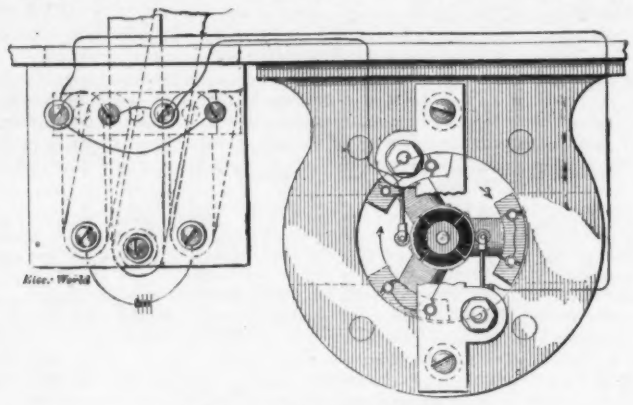
545,494. RAILWAY BLOCK SIGNAL SYSTEM; J. W. Ball, New York, N. Y. App. filed June 15, 1895. A system consisting of a block signal, a circuit closer in conjunction therewith and adapted to be operated thereby; an automatic supplemental signal for the said block signal and a normally closed circuit including a track instrument.

545,495. SUPPORT FOR OVERHEAD ELECTRIC CONDUCTORS; Mt. Hanford, Springfield, Mass. App. filed April 25, 1894. The combination of a coupling member having an open socket and a flattened bolt extending from side to side, another member having a hook adapted to fit the rounded portion of the bolt, and a lug adapted to engage an edge of the socket.

545,520. TROLLEY GUARD; J. T. Moody, W. Shawd and A. J. Baker, Springfield, O. App. filed Feb. 23, 1895. A trolley guard having lateral guards and a latch guard journaled to one of the lateral guards and normally projected across the space between the said lateral guards.

545,524. ELECTRIC MOTOR; J. O'Neill, New York, N. Y. App. filed June 22, 1894. The combination of magnets and a revoluble armature having radial arms with heads carried upon the ends of the same, helices coiled upon the arms and extending through bores in the same to promote the magnetization of the heads, and a commutator for making and breaking the current in succession through the helices.

545,533. TELEGRAPH KEY; G. F. Philbrok, Lisbon Falls, Me. App. filed Jan. 19, 1895. A key having a pivoted button with a turned up edge to facilitate the lifting of it, and countersunk weights near the outer part of its periphery to insure the falling over of it when left without pressure.



545,524.—ELECTRIC MOTOR.

545,554. ALTERNATING-CURRENT GENERATOR OR MOTOR; E. Thomson, Swampscott, Mass. App. filed Sept. 29, 1891. The combination of an armature having a series of windings which are alternately reversed and a field magnet having poles each subdivided into separate polar projections.

545,570. ELECTRIC COAL OR ROCK DRILL; H. H. Bliss, Washington, D. C. App. filed Sept. 6, 1888. The combination of a rotary armature, a field magnet having two poles adapted to lie either in a vertical line one above the other, or in lines inclined to the vertical, and the axial support for the said magnet bodily movable vertically.

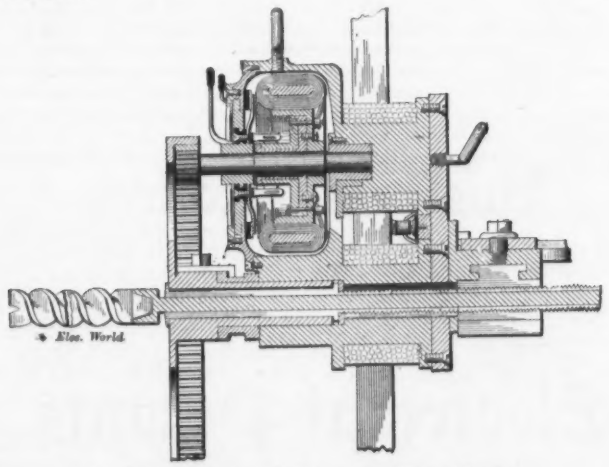
545,591. Filed April 23, 1894; 545,592, filed May 10, 1894. ELECTRIC MOTOR; O. E. H. Kramer, St. Louis, Mo. The combination of two motors having stationary field magnets and revolving armatures, the armature being supported on a single shaft and the shaft carrying a pulley.

545,620. CLEAT FOR ELECTRIC WIRES; M. M. Wood, Chicago, Ill. App. filed Jan. 11, 1895. A cleat having an opening which is straight at each end, but within the cleat is formed so as to have an hump or bend to prevent movement of the wire or wires.

545,629. SAFETY APPLIANCE FOR ELECTRIC CONDUCTORS; A. E. Hutchins, Detroit, Mich. App. filed May 5, 1893. The combination of blocks connected with sections of an electric conductor, a frame to receive and hold said blocks, arms pivoted within the said frame, bearing upon the blocks and operated by springs.

545,637. TELETYPER; C. Spiro, New York, N. Y. App. filed Dec. 18, 1894. The combination of a typewriter machine and a key lever having a contact arm co-operating code signal devices, an oscillating bar carrying said devices, and means for locking the bar out of operative position.

545,639. SIGNAL BOX; N. H. Suren, New York, N. Y. App. filed March 8, 1895. The combination of two doors, the inner one having holes through which the non-interfering and cut-out devices are operated by studs on the outer door.



545,570.—ELECTRIC COAL OR ROCK DRILL

545,649. TROLLEY ARRESTER; H. F. Hildebrand, Rochester, N. Y. App. filed May 6, 1895. A case containing a spring and adapted to be hung on the dashboard, having a cord or rope connected therefrom to the trolley pole.

545,653. ELECTRIC ALARM; W. S. Hull, Dallas, Tex. App. filed Nov. 26, 1894. The combination of a magnet and its armature, a contact point, a sliding bar carrying one contact point and adapted, when moved in either direction, to fall off of the vertical contact and bring the said contact and the conducting part of the sliding arm into contact.

545,664. METHOD AND APPARATUS FOR CONTROLLING CURRENTS; T. Von Zweigberck, Cleveland, O. App. filed Nov. 1, 1894. The combination of a switch having thereon controller strips and arc spanning strips, with corresponding fingers adapted to engage with some of the controller strips in every position of the switch and with the arc strips in alternate positions thereof.

545,670. ELECTRIC TRANSFORMER; W. F. Britton, Allegan, Mich. App. filed Nov. 16, 1894. A transformer having the primary and secondary coils each coated with a solution, and with the secondary coil wound within, and insulated from the primary coil, and also a core around which the said coils are wound.

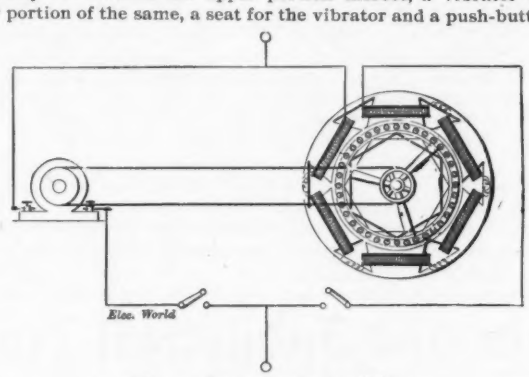
545,686. TROLLEY; Z. T. Furbish, Augusta, Me. App. filed July 12, 1895. A trolley composed of a forked rod with depending arms, a trolley wheel journaled between the arms and adapted to incline laterally in relation to the same.

545,693. ASYNCHRONOUS MOTOR; M. Hutin and M. Leblanc, Paris, France. App. filed April 19, 1895. A motor consisting of a single row of alternately wound field magnets, adapted to be energized by a single-phase current, a rotatable flux screen and a rotating armature and means for starting the rotation of the flux by external power.

545,694. ELECTRIC ARC LAMP; R. H. Jahr, Opladen, Germany. App. filed Nov. 26, 1894. A lamp having upper and lower carbons, a regulating helix, a main regulating resistance, an auxiliary resistance, and a connection between the auxiliary resistance and the main regulating resistance.

545,701. SEMAPHORE SIGNAL FOR RAILWAYS; J. W. Lattig, W. Bethlehem, Penn. App. filed Jan. 5, 1895. A semaphore having a row of lamps extending along its length, a commutator, whereby whenever the commutator is in operation the lamps on the semaphore will be intermittently and successively put into circuit so as to produce upon the eye the effect of a continuously moving streak of light running lengthwise of the semaphore blade.

545,726. INDICATOR; B. F. Ritterhouse, Philadelphia, Pa. App. filed April 13, 1895. An indicator consisting of a tube, a coil surrounding the same, a stationary core within the upper portion thereof, a vibrator within the lower portion of the same, a seat for the vibrator and a push-button.



545,693.—ASYNCHRONOUS MOTOR.

545,736. ELECTRIC ARC LAMP; R. Segerdahl, Chicago, Ill. App. filed April 26, 1894. The combination of two or more movable electrodes each having an independent regulating mechanism in derived circuit, switching devices adapted to cause the regulating mechanism to operate in a predetermined sequence, whereby the electrodes may be caused to burn in succession.

545,755. CARBON HOLDER FOR ELECTRIC LAMPS; T. E. Adams, Cleveland, O. App. filed Feb. 15, 1895. The combination of a holder having a fixed and a movable jaw, and a yoke and a thumbscrew adapted to tighten all of the parts.

545,806. TROLLEY WIRE SUPPORT; J. W. Meaker, Evanston, Ill. App. filed Nov. 17, 1894. A support or hanger having an inclined upper edge, a clip having a similar edge also and adapted to receive the hanger and to be wedged thereupon.

545,815. ELECTRIC SIGNALING APPARATUS; B. Price, Baltimore, Md. App. filed April 24, 1894. A wheel having a normally forward movement and provided with a mechanical arrangement of solid keys formed in the shape of an inclined plane; an armature lever with a single finger to co-operate with the inclined plane and shoulder of the key-bars, and thereby secure a fixed starting and stopping place with each movement.

545,819. ELECTRIC INSULATOR; D. M. Rothenberger, Lancaster, Pa. App. filed March 8, 1895. An insulator having a curved circumferential groove for the main wire, a transverse opening beneath the groove, and vertical or side openings communicating with the curved grooves.

545,833. BOND FOR ELECTRIC RAILWAYS; E. S. Wheeler, Saugatuck, Conn. App. filed Jan. 14, 1895. A bond provided with inwardly extending projections running through the rails, and a chair flange which is recessed to receive the bond which is located between the flange and the rail.

545,835. ELECTRICAL BURGLAR ALARM; J. R. Alexander, New Albany, N. Y. App. filed March 20, 1895. The combination of a frame carrying circuit wires, a grating composed of tubes detachably connected to the frame wires being in each tube, sockets carrying wires also and being normally out of contact with each other but in contact with the circuit wires at their other ends, and doors and leaves adapted to close over the circuit wire when the grating is removed.

545,853. ROTARY FIELD MOTOR; A. E. Du Bois Reymond, Berlin, Germany. App. filed Dec. 26, 1893. The combination of a number of coils each connected at points with contact terminals arranged in a circle, brushes one for each coil mounted to be moved over the terminals and adapted to make contact with corresponding terminals of the several coils whereby the effective lengths of the several coils may be varied at will.